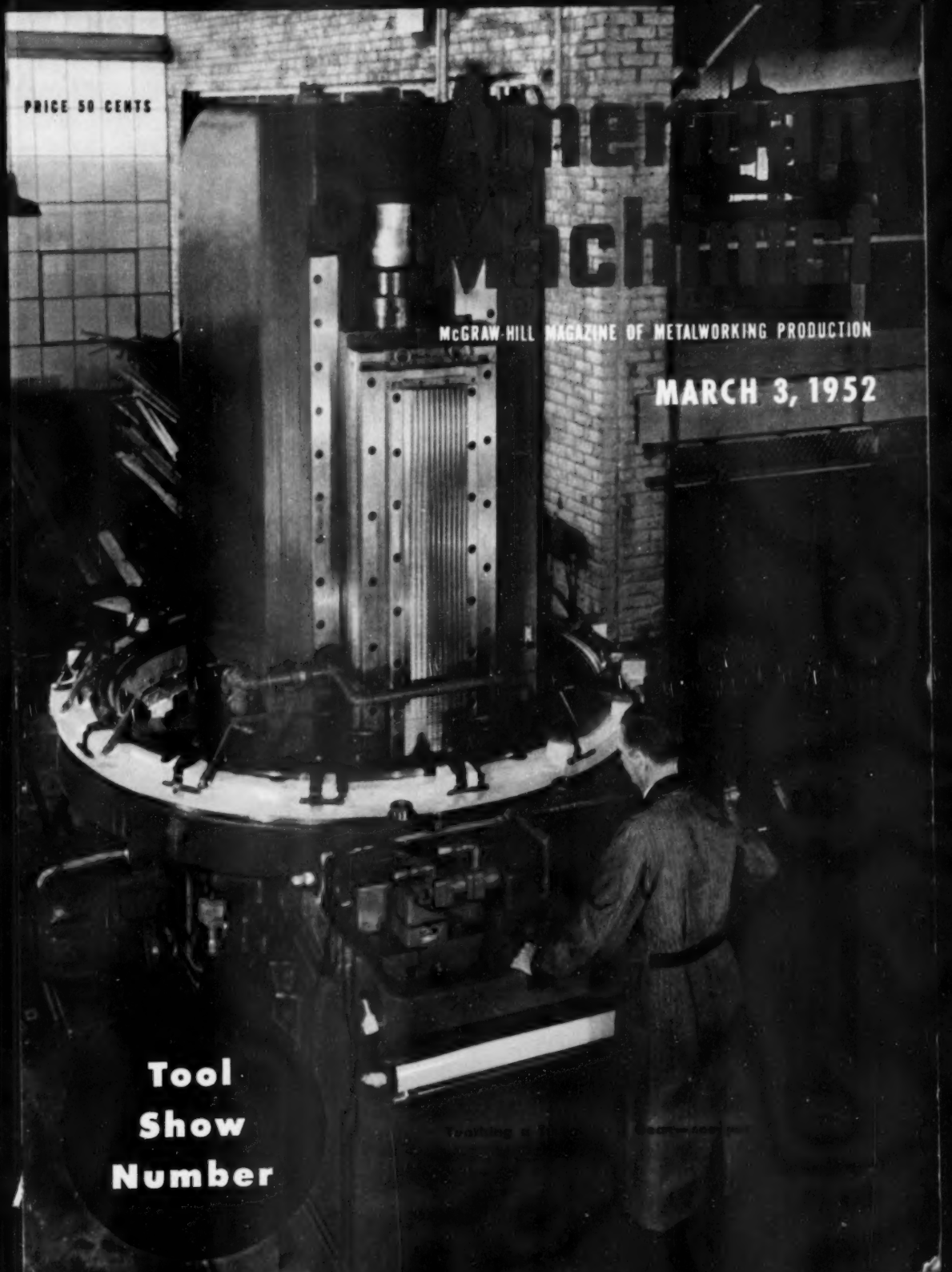
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American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
MARCH 3, 1952
Tool
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helps you get
CLEANER, SAFER, BETTER OPERATION

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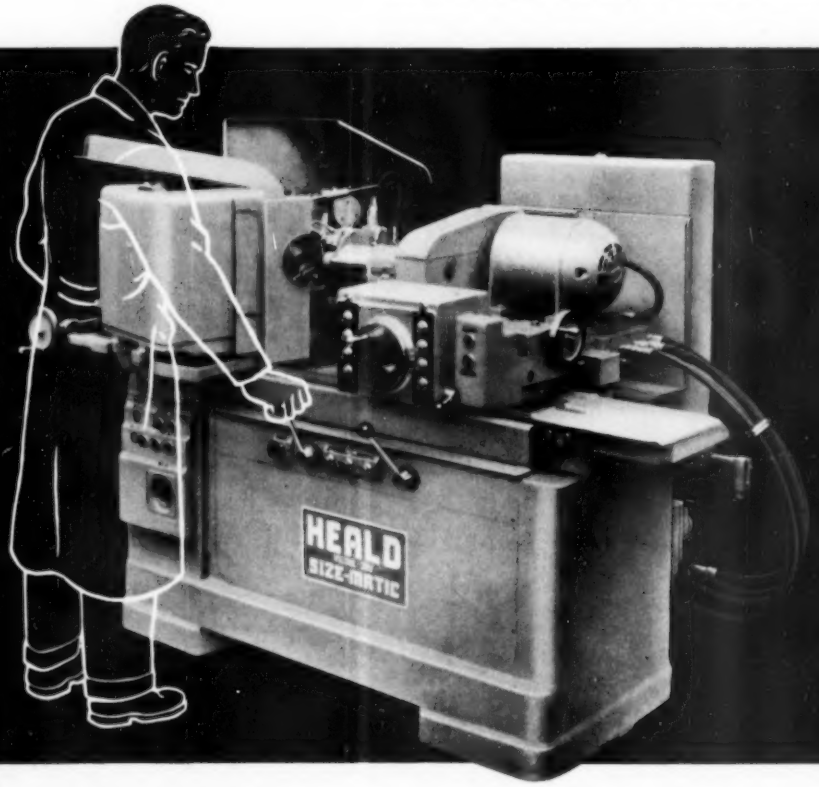
Guarding is an exact science here at Heald. Every machine is equipped with guards and covers that give maximum safety to operators — prevent spattering of coolant — keep chips, dust and dirt from interfering with machine operation.

This three-way guarding is particularly important right now. It protects you against loss of production. So make sure that all guards and covers are properly in place when the machine is in operation. This simple precaution can help you *get the most* out of your precision-built Heald Grinding Machines and Bore-Matics.



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Chips and QUIPS

Saves $400 A Day . . . 294 internal 4-pitch teeth (25° PA, 73.5-in. PD, 0.525 in. deep, 1.385-in. face) must be cut to a spacing tolerance of ±0.001 in. on the ring gear for a tank turret at Detroit Tank Arsenal. Andrew C. Dickson, civilian chief of mfg there, nettled at the 4½ hr required to cut the teeth by conventional methods, proposed broaching. Several experts assured him it wouldn't work—so he and his assistants hunted up a World War II surplus Colonial broach (30-ton, 66-in. stroke) and sent it back to Colonial. Engineers there took the hydraulic-power equipment out of the column, set it on an outside base, repiped the system, and encircled the column with a 4-ton indexing and shuttling fixture, accurate to 0.0005 in. eccentricity per foot. They tooled it with an 11-tooth, 12-segment surface broach 9 in. wide and 60 in. long—all the machine would take.

Now, a hydraulically controlled locking cam action shuttles the fixture into position under the broach, the broach passes down, the fixture shuttles back off, and the broach returns. The ring is clamped in the fixture by the hand levers, but is ejected hydraulically for unloading. Indexing control is independent of broach operation. The ring is completed in 30 min, at ⅓ the capital outlay for previous methods and ⅛ as many machines. Teeth are checked for spacing and size by a gage built in.

Sectional Dies . . . Third in our NTDMA series is the fruits of an interview with Herbert Harig of Chicago, showing how dies can be made in sections, permitting surface grinding of profiles with formed wheels. Illustrated are various methods of locating and anchoring sections in the shoe, and several kinds of grinders which produce blank profiles.

Phenomenological . . . We've had half a dozen brand-new tooling ideas under observation for months: arc machining, CO_2 as a coolant, sprayed-metal parts, carbide burs doing a tough grinding job, manufacture of experimental turbojet blades (including a new spark-gap contour follower and a potential punch-card blade miller), and the latest about drilling titanium. We added, for good measure, a Special Report on graphing form tools, some pointers from an expert on making sectional carbide dies, and a new process: microbroaching. All are directly related to the defense program, all are new and exclusive. The occasion? The forthcoming ASTE Industrial Exposition in Chicago the week of Mar. 17. You'll also find a floor plan of the exposition, a list of exhibitors, and the new equipment to be shown.

Milling and Broaching . . . The NACA laboratory in Cleveland has the job of producing developmental jet engines, and a major problem is all sorts of blade shapes in impossible materials, quickly and accurately. How it's done economically makes a story full of ideas . . . And John Denison, who wrote the popular article on dealing with contract shops (*AM*, Nov 18, '48) comes back with the description of a new technique — microbroaching. This one will intrigue you, too.

Unmachinable . . . Recent gossip where tool men gather has centered about two solutions to the problem of machining the "unmachinable" new alloys, arc machining, and CO_2 as a cutting fluid. Both are described in this issue by prime movers in their application. The story on arc machining, by Elox Engineers Harding and Matulaitis, describes development of the process and recent applications. Paul Brunberg gives the principles and applications thus far of CO_2 cooling in machining.

And . . . Last-minute additions to this issue include the description of International Harvester's quality-control system and what it has saved—to be exhibited at the Show . . . We've also a story on how Studebaker makes crankshafts and finishes them.

Coming . . . After our Tool Show Number, what can be left? Plenty—and you'll find some in *AM* for Mar 17. There's a 16-page Special Report on how Ford automatized the new Cleveland engine plant, articles on when and why a special machine, induction brazing, hot-platen presswork, electrically conductive glass, slotting cast segments, and on Draper's replacement program. The ideas are packed in.

TOOL DESIGNER . . . **Prof. J. H. Porsch, author of the Special Report on forming tools in this issue, has a background in practical engineering as well as education. He was graduated from Purdue University in 1928 in Civil Engineering, and added a master's degree to his record a few years later. His practical experience was with American Steel Dredge Co., Bowser & Co., General Electric Co., and Giffel, Valet, and Cole; mainly in their engineering departments. He taught for a year as an exchange professor at Ohio State University, and is now a full professor and head of the Engineering Drawing and Descriptive Geometry section at Purdue. He has published a book on descriptive geometry, and works part-time as a consulting engineer. He is a registered civil engineer, and belongs to ASCE.**

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When your straight bevel gear production requires more equipment, the No. 7 Revex Rougher gives you rapid, close roughing of tooth taper and profile shape more rapidly . . . frees your No. 14 Straight Bevel Generator from roughing so that full production time can be used for finishing . . . leaves little metal for finishing tools to remove . . . tools last longer, thus providing a superior quality in the completed gear.

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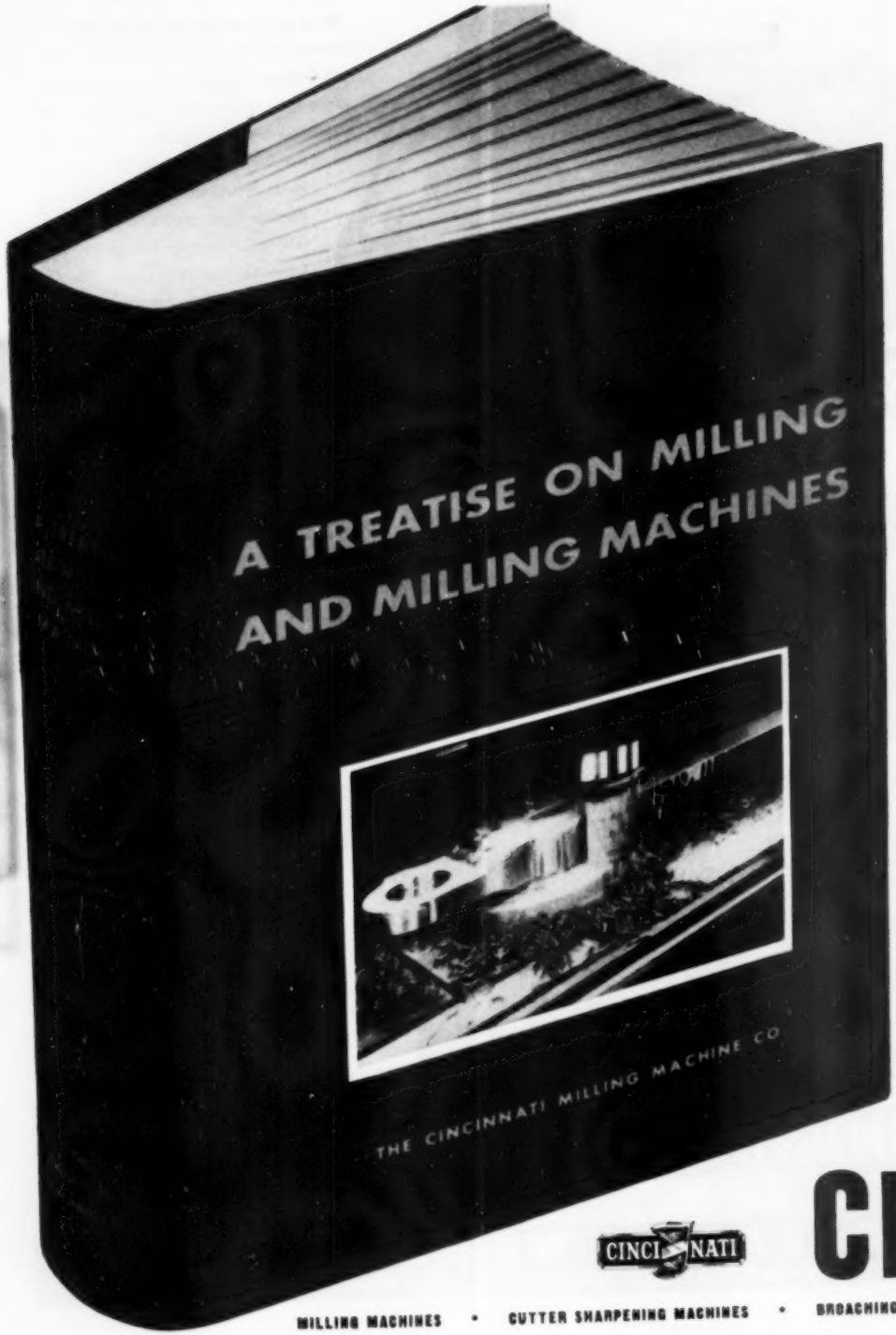

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CHAPTER 4 Milling Cutter Materials
CHAPTER 5 Milling Cutter Elements
CHAPTER 6 Sharpening Milling Cutters
CHAPTER 7 The Milling Process
CHAPTER 8 Chip Formation, Surface Finish, and Cutting Fluids
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CHAPTER 14 Milling Cams and Other Surfaces of Curved Contour
CHAPTER 15 Milling Dies, Molds, and Parts of Cylindrical or Irregular Contour
CHAPTER 16 Diversified Uses of Milling Equipment in Toolroom Work
CHAPTER 17 Production Milling
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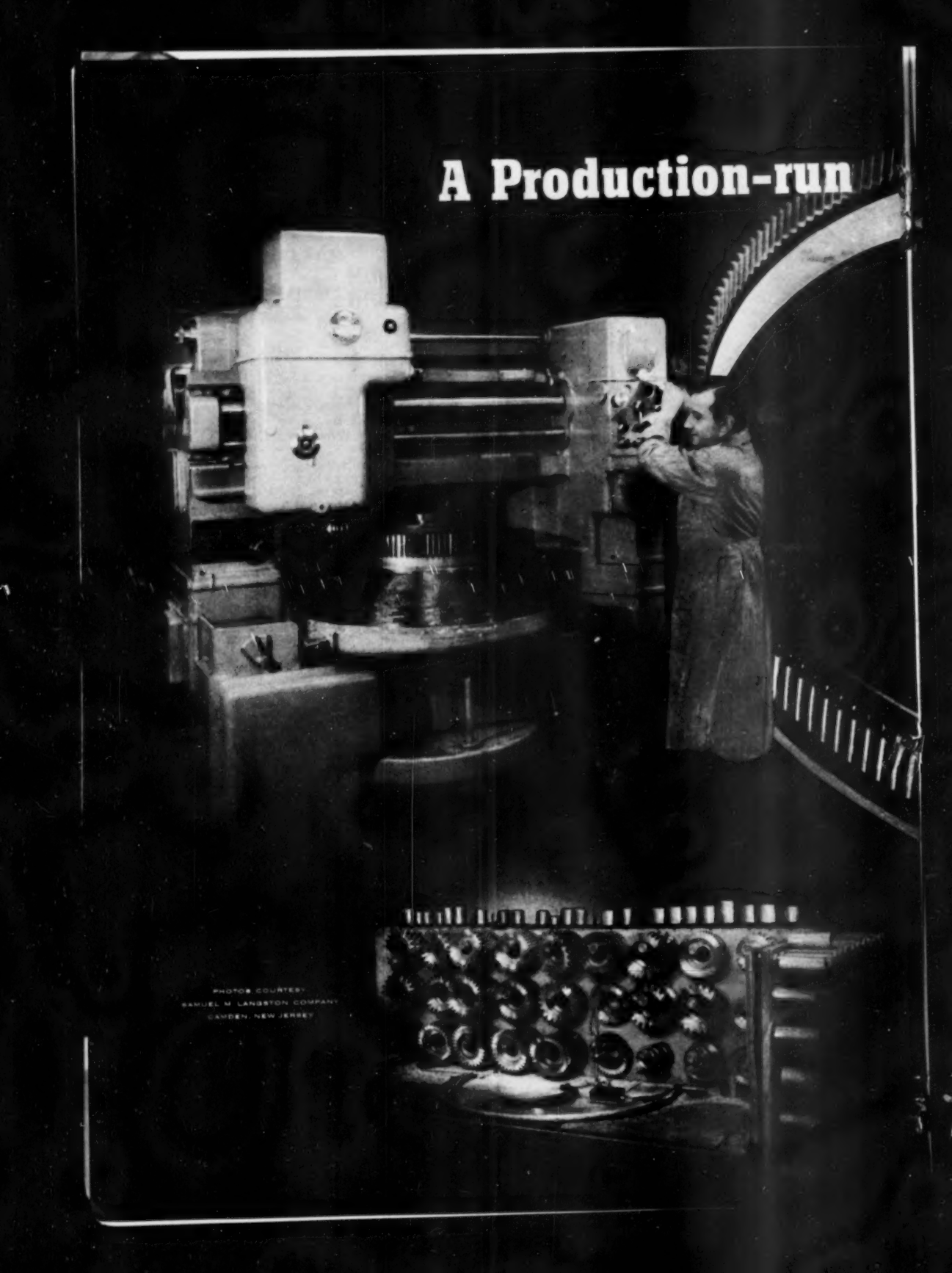

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Jobbing Shop F...BILITY

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Ultra-modern design in this general-purpose machine, provides a combination of advantages never before available:

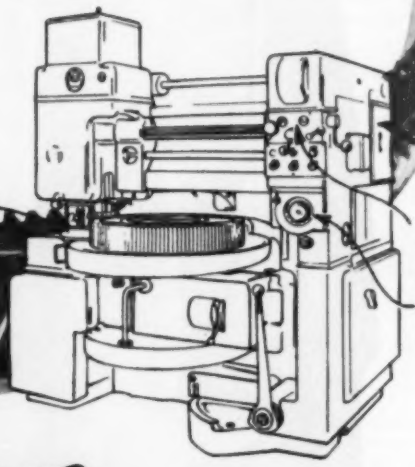
1 You can cut spur or helical gears—from broad-face pinions up to gears of 36" p.d.—external *or internal*. You can cut herringbone gears, cams, ratchet teeth, splines, special contours, etc.

2 You can use .034" feed and "rough-out" a coarse-pitch gear or pinion—fast! Or maybe a quick shift-over to fine feed in finish-cutting on finer-pitches.

3 You can have 300 strokes per minute cutter-spindle speed for fast stock removal on a thin ... Or any one of 12 changes, ... strokes per minute in ta... cuts on wide-face gears.

4 You can cut up to 6 inches face ... on the standard machine.

5 With an assortment of standard cutters you are ready to turn out multiple production runs, fast—or shift from one item to another "with the greatest of ease". Whatever your tooling situation at the moment, if you've cost cutting in mind, it will pay you to get complete details at the nearest Fellows office on the 36-Type Fellows Gear Shaper.



...lind quick access ...oor, simple adjust-ment controls the length of stroke (up to 6" face width standard).

Control for quick selection of twelve different cutter speeds. (Strokes per minute.)

Dial setting for number of cuts to be taken, automatically stopping machine when cycle completed.

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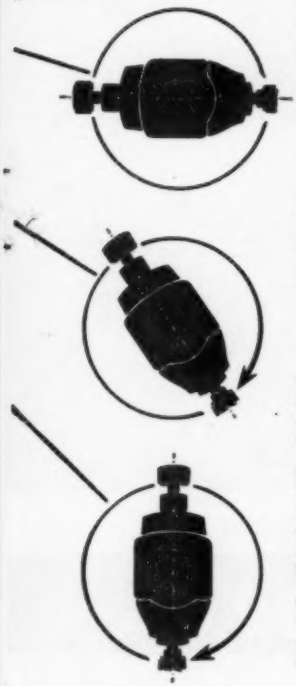
Van Norman Features More Profitable Milling Costs with the

22L Ram Type Miller



The versatility of the Van Norman No. 22L miller enables it to meet the daily fluctuating milling requirements in all types of plant work. It minimizes idle machine time, reduces work re-setups, provides more profitable milling at lower costs.

Here's how — the adjustable cutterhead permits horizontal, angular and vertical milling on one miller. Because setups are minimized, errors that often occur when workpiece is changed are eliminated. Overall milling machine capacity . . . vertical to horizontal . . . is always at peak efficiency.

In addition, front and rear directional controls provide ease of operation . . . reduce operator fatigue . . . increase efficiency. Conveniently located speed and feed selectors permit quick selection of proper speed and feed. Rugged construction throughout assures long operating life. Investigate the Van Norman No. 22L Ram Type Miller for your plant. Write for bulletin.

Important Van Norman Features

• VERSATILITY
Rugged adjustable cutterhead permits horizontal, vertical or angular milling . . . all on ONE machine . . . with standard tooling.

• EASE OF OPERATION
Finger-tip front and rear control of all power feeds. . . . Front and rear 6-way rapid traverse. . . . Large easy-to-read graduated dials. Aluminum alloy arbor supports for easy handling.

• SIMPLICITY OF CONTROL
All power feed controls are DIRECTIONAL — operate in direction of desired table, saddle and knee movement. . . . Rotary-type feed selector. . . . Convenient and accessible speed selector.

• INCREASED RANGE
Ram adjustment, in and out over column, provides added work range and capacity.

• RIGIDITY AND POWER
Spindle transmission gears are made of hardened alloy steel. . . . Lapped to assure smooth precision operation. . . . Multi-spline shafts operate on taper roller bearings. . . . Rugged column and base. . . . Massive knee.

• LONG LIFE
Precision built. . . . Automatic lubrication.

COMPANY, SPRINGFIELD 7, MASS.

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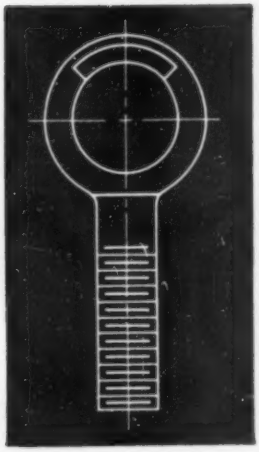
—45.5% of Former Cost!

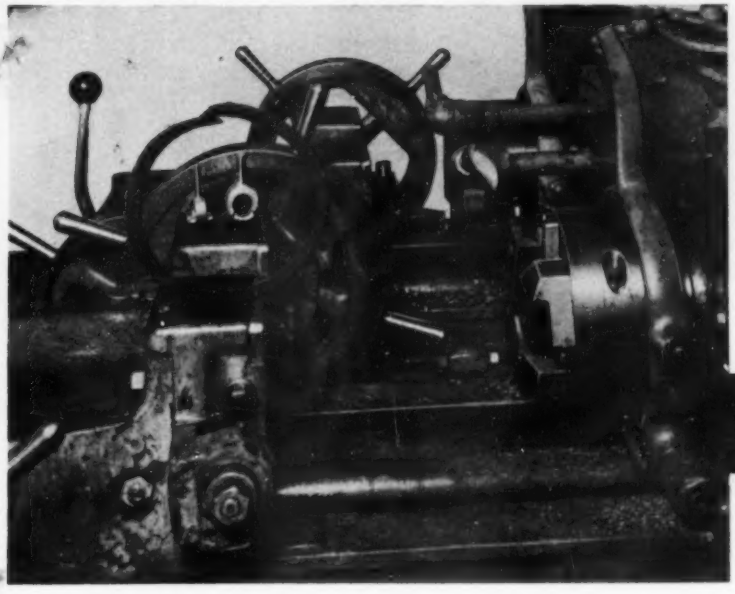


Eye bolts, for use in the assembly of switchgears, are now threaded on 1" Double LANDMACO Leadscrew Threading Machines in the Philadelphia plant of a large Eastern manufacturer. Records show that costs by previous methods averaged 120% higher.

Three sizes of eye bolts are threaded from high tensile bronze and copper castings—⅜", ½", and ⅝" 16, 13 and 11 pitch National Coarse threads respectively are cut for lengths varying from $^{15}/_{16}$" to 1⅝" at cutting speeds of 302 and 217 RPM's.

Lower tool cost has been an important factor in the overall cost reduction from threading these parts with LANDIS Equipment. Approximately 25,000 pieces are produced between each regrinding of the chasers. This combined with the fact that LANDIS Chasers are reground and used for most of their original length has brought tool cost down to a minimum.

This is one of many examples where LANDIS Threading Equipment has significantly reduced operating costs—others show increased production, better quality, lower maintenance, etc. Further information on LANDMACO Leadscrew Machines and all LANDIS Threading Equipment will be furnished promptly on request. Please give specifications when writing.



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Output per operator tripled

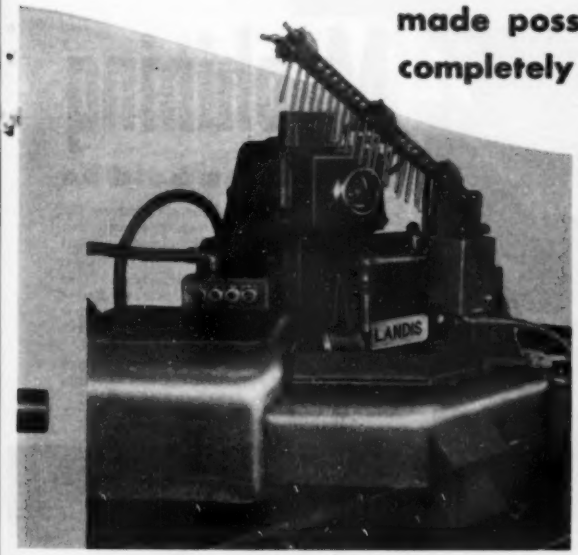
LANDIS Type H Automatic Valve Face Grinding Machine

LANDIS

precision grinders

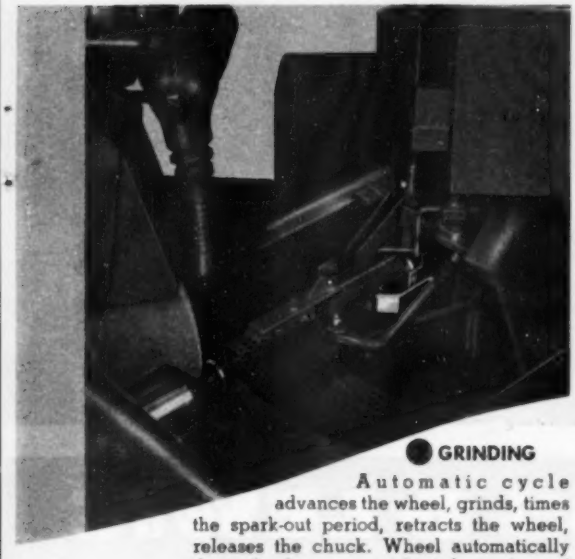
...grinding valve faces

made possible by completely automatic operation

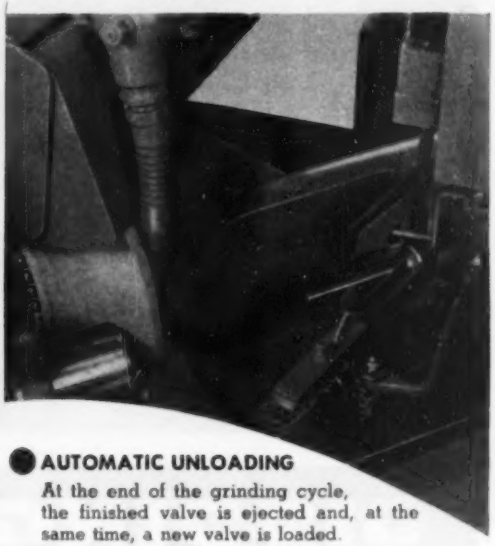


GRAVITY FEED Valves switched off conveyor to an inclined track without handling by operator.

AUTOMATIC LOADING Power operated loader advances each valve and inserts it in revolving hydraulically operated collet chuck.



GRINDING Automatic cycle advances the wheel, grinds, times the spark-out period, retracts the wheel, releases the chuck. Wheel automatically dressed after a pre-selected number of valves are ground, and cycle is resumed.



AUTOMATIC UNLOADING At the end of the grinding cycle, the finished valve is ejected and, at the same time, a new valve is loaded.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

Machining

tolerances held to

Here's how one manufacturer put heavy machining on a production basis—at a saving of nearly 75%!

Harnischfeger Corp., Milwaukee, used to machine heavy, bulky weldments on several different machines, each requiring a separate setup. Each increasing lost-time — adding labor costs.

Now—in one setup—through the use of this big, new Giddings

GIDDINGS & LEWIS

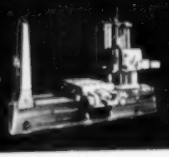
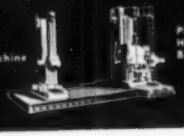
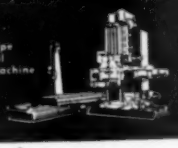


Table Type Horizontal Boring Machine



Floor Type Horizontal Boring Machine



Planer Type Horizontal Boring Machine

Hypro Open-Side Planer

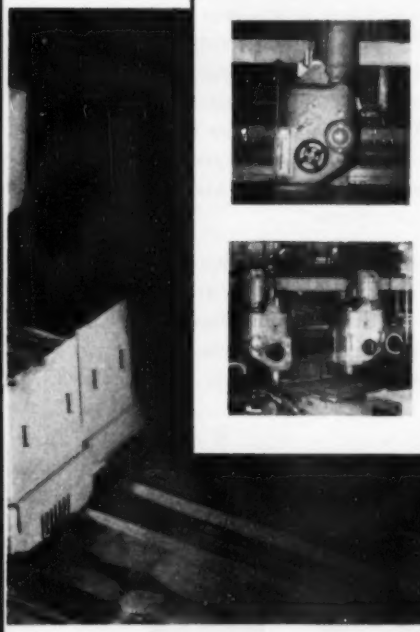
costs cut 75%

.002" on huge weldments

& Lewis planer-miller — capable of performing several operations in a single setup — all of this has changed. Today, Harnischfeger machines, on a strictly production basis, weldments as large as 12' x 9' x 24' — to tolerances within a .002". Overall machining costs reduced approximately 75%.

This is another example of the G&L 5-Point Job Analysis in action. Based on a comprehensive survey of Harnischfeger shop time and work requirements, the new G&L planer-miller checked on every count . . . offered immediate solution to curb ever-increasing costs.

Check the material at the right. See how it may pay you to get a G&L 5-Point Job Analysis.



Each head has its own scales and verniers plus a dial indicator with which gage blocks or measuring rods can be used. Result: *No layout work is required before milling.*

The rail is raised and lowered by a 45-hp motor which also feeds and traverses heads by spline-shaft and bevel-gear drives.

Both rail heads work together to profile-mill the circular roller-bearing path. 12-in. cutters are used on the 10-in. spindles, each driven by a 50-hp motor. Head and table feeds are tied together for the job by manipulation of individual head controls in either push-button station or either pedestal.

G&L 5-POINT JOB ANALYSIS

takes the guesswork out of machine tool buying . . works for you and with you to solve big or complex machining problems..increases production . . reduces machining costs

1 **COMPLETE STUDY OF YOUR JOB OR JOBS** — G&L Job Analysis Engineers, working with your engineers, analyze your requirements by: (1) number and size of parts to be produced, (2) number and kind of operations needed, (3) tolerances and finishes required.

2 **DETERMINE MOST EFFICIENT MACHINING METHOD** — Taking into consideration the individual machining requirements of the job, G&L Job Analysis Engineers choose the most efficient machining method. G&L engineers can give an unbiased opinion because G&L builds a complete line of sizes and types of planers, planer-millers, vertical boring and turning mills and horizontal boring, drilling and milling machines . . . plus a complete line of accessories and tooling for these machines.

3 **SELECT THE SIZE, KIND AND TYPE OF MACHINE**—The machining method now determined, G&L Job Analysis Engineers — using your production and work requirements — recommend the exact size, kind and type of machine that will do the job most efficiently.

4 **PLAN YOUR OPERATIONS** — After the selection of the most efficient machine to fit your needs, G&L Job Analysis Engineers plan a sequence of operations that will (1) minimize number of setups and setup time, (2) use modern cutting tools to best advantage, (3) take full advantage of the machine working ranges and capacities, (4) keep operator fatigue to a minimum.

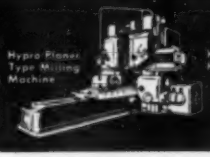
5 **RECOMMEND (AND DESIGN IF NECESSARY) THE TOOLS TO USE** — If conditions warrant, G&L will recommend the standard machine accessories, arrangements and tools you can use to make your equipment more productive—more versatile in application. If special equipment is needed, it will be designed to agreed specifications and made a part of your order.

Write, wire or phone G&L, or its nearest representative today. Get the facts on your needs — your problems. Get a G&L unbiased Job Analysis to help you. Don't hesitate — there's no obligation . . . AND DELIVERY MAY BE BETTER THAN YOU THINK!

How to get a G&L job analysis

Call your nearest G&L dealer or write us direct. Furnish our Job Analysis Engineers with blueprints, job data, and production requirements. Factory engineers will completely analyze your machining problems. There's no charge, no obligation. Don't hesitate — do it today.

MACHINE TOOL CO.



Hypro Planer Type Milling Machine

Hypro Double Housing Planer

Hypro Vertical Boring and Turning Mill

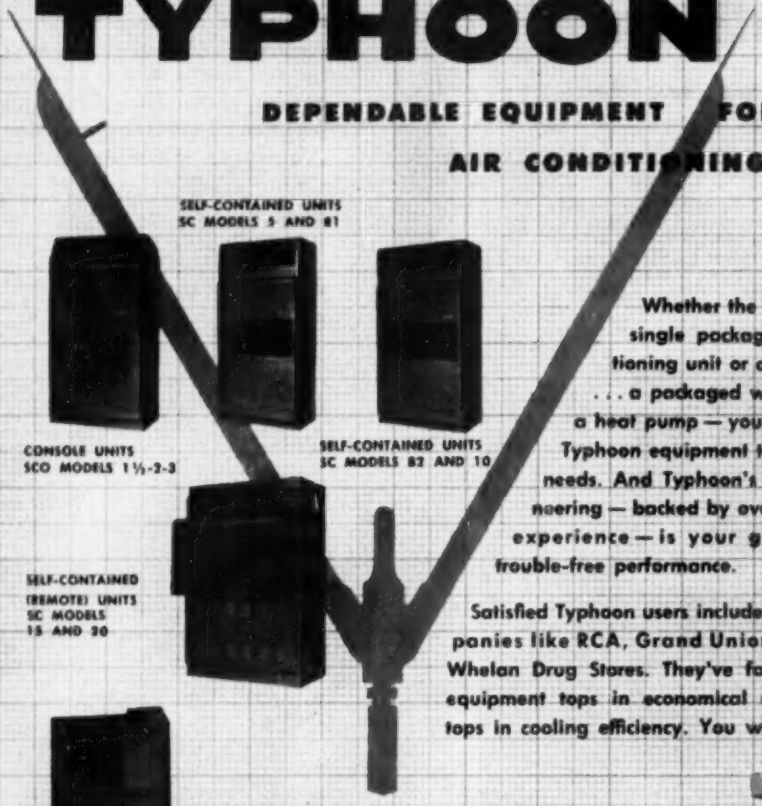
G&L HYPRO

FOND DU LAC
WISCONSIN

Quality-Engineered by

TYPHOON

DEPENDABLE EQUIPMENT FOR YOUR AIR CONDITIONING NEEDS



SELF-CONTAINED UNITS SC MODELS 5 AND 81

CONSOLE UNITS SCO MODELS 1½-2-3

SELF-CONTAINED UNITS SC MODELS 82 AND 10

SELF-CONTAINED (REMOTE) UNITS SC MODELS 15 AND 20

EVAPORATIVE CONDENSERS EC MODELS 3-5-8

EVAPORATIVE CONDENSERS EC MODELS 10-15-20

AIR HANDLING UNITS

PACKAGED WATER CHILLERS

HEAT PUMPS

Whether the job calls for a single packaged air conditioning unit or a central plant . . . a packaged water chiller or a heat pump — you can count on Typhoon equipment to supply your needs. And Typhoon's quality engineering — backed by over 40 years of experience — is your guarantee of trouble-free performance.

Satisfied Typhoon users include famous companies like RCA, Grand Union Stores and Whelan Drug Stores. They've found Typhoon equipment tops in economical operation . . . tops in cooling efficiency. You will, too.

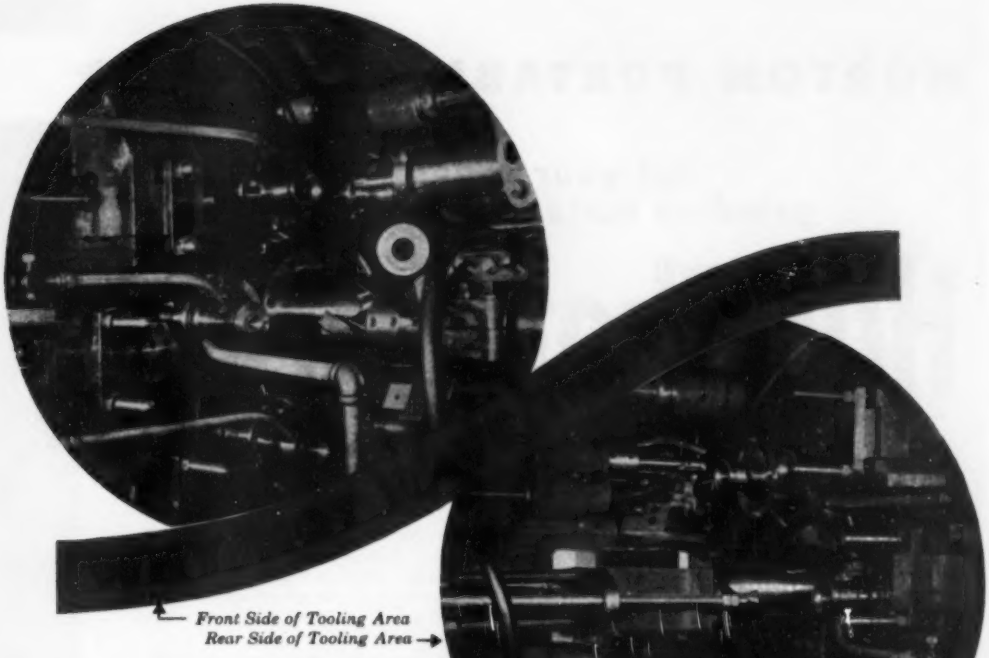
ALSO — WINDOW UNITS, BOILERS, COILS AND MULTI-PACKAGED SYSTEM UP TO 60 TONS.

Write for Detailed Information

TYPHOON AIR CONDITIONING CO., INC.

794 Union Street, Brooklyn 15, N. Y.

Specialists in Air Conditioning Since 1909



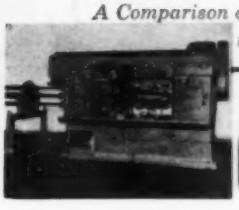
Front Side of Tooling Area
Rear Side of Tooling Area

If you have a tough forming job in mind for a new "automatic," it's more satisfactory to know the recommended maximum load of the proposed machine's cross slides than to merely be told that they are *rugged.*

Before a machine can satisfy an important requirement it must be *built that way.* And built to figures instead of adjectives.

There are many factors involved in the building of any brand of Multiple Spindle Bar Automatic, factors on which you may want the figures. You may have the figures on CONOMATICS.

A Comparison of ALL Automatics is in Favor of Cone



In producing the alloy steel part shown, the maximum load recommendation for each main cross slide of the 3½-SIX is 8,000 foot pounds. The total net weight of the main cross slides is 825 pounds.

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

NORTON PORTABLE GRINDING

cut your rough grinding costs because they . . .

Hug That Work!

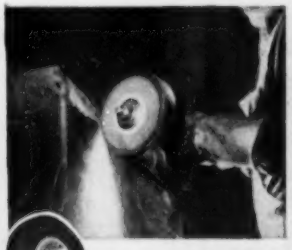
YOU FEEL THE DIFFERENCE when you put Norton portable grinding wheels to work. *They hug that work.* Less bounce . . . less vibration. Their more-continuous contact with the work pays off three ways. It means faster grinding, longer wheel life and less operator fatigue. You *see* this difference when you add up your costs.

This cost-cutting, work-hugging feature of Norton portable grinding wheels comes from *controlled uniformity* and *built-in balance* . . . recently obtained by Norton production engineers to a degree never before achieved. It's the revolutionary new Norton manufacturing process that helps you cut your grinding costs.

Ask your nearby Norton distributor about the new, improved Norton portable grinding wheels. He's listed under "Grinding Wheels" in your classified telephone directory. Or write direct to Norton Company, Worcester 6, Mass. Distributors in all principal cities.

EXPORT: Norton Behr-Manning Overseas Inc., Worcester, Mass., New Rochelle, N.Y.

Work-Hugging Norton Portable Grinding Wheels are cutting costs on jobs like these:



GRINDING DOWN HEAVY WELD on a fabricated steel machine base is one of many jobs done best by Norton straight wheels. No other wheels *hug that work* so closely . . . remove so much metal per man-hour . . . last so long.

ROUGH GRINDING A SHIP'S PROPELLER is typical of the tough jobs that Norton cup wheels make easy. Fast-cutting and long-lasting, they do an extremely efficient job with a minimum of operator fatigue.

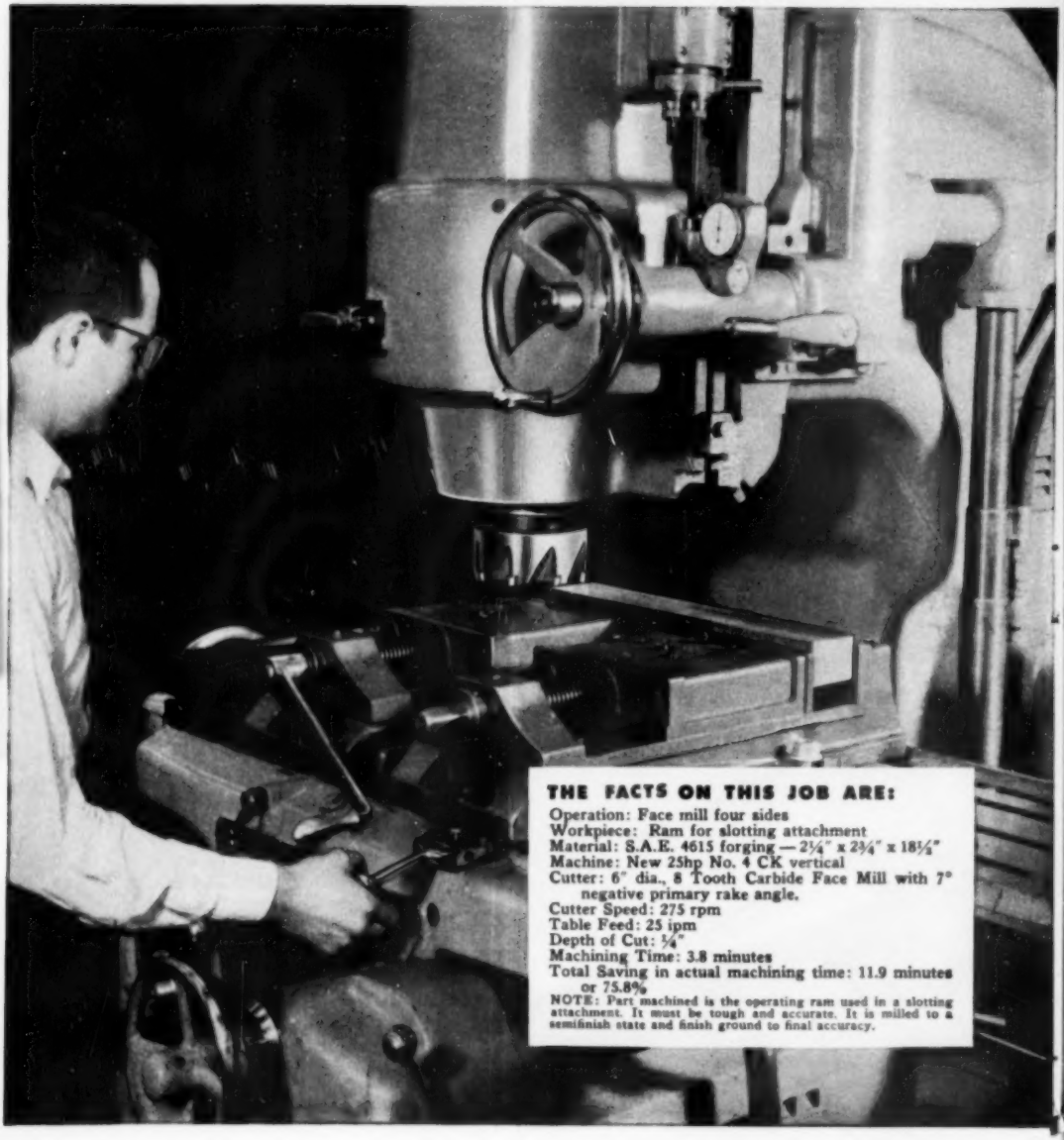
SMOOTHING DOWN WELDS is a quick, easy, safe job with Norton REINFORCED Hub Wheels. The two types — the rigid BD and the more flexible BFR — make it possible to handle any weld grinding job correctly.

NORTON ABRASIVES

Making better products to make other products better

WHEELS
SEE the new flexible NORTON
REINFORCED RESINOID hub
wheel at the A.S.T.E. Show—
Chicago — Space 1039

facts tell the story NEW CUTS



THE FACTS ON THIS JOB ARE:

Operation: Face mill four sides
Workpiece: Ram for slotting attachment
Material: S.A.E. 4615 forging — 2¼" x 2¾" x 18½"
Machine: New 25hp No. 4 CK vertical
Cutter: 6" dia., 8 Tooth Carbide Face Mill with 7° negative primary rake angle.
Cutter Speed: 275 rpm
Table Feed: 25 ipm
Depth of Cut: ¼"
Machining Time: 3.8 minutes
Total Saving in actual machining time: 11.9 minutes or 75.8%

NOTE: Part machined is the operating ram used in a slotting attachment. It must be tough and accurate. It is milled to a semifinish state and finish ground to final accuracy.

KEARNEY & TRECKER MILWAUKEE CK MILLING MACHINE PRODUCTION TIME 75%

4615 ALLOY STEEL FORGING MILLED IN 3.8 MINUTES . . . FORMER TIME 15.7 MINUTES

C-K MILLING MACHINE FEATURES THAT HELP DO THIS JOB BETTER

Greater rigidity of new CK column easily absorbed vibration from heavy cutting load. Only single pass needed for each part.

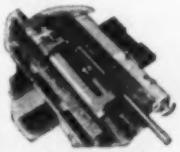
New CK machines have Greater Horsepower. On this job, 25hp permitted operator to get maximum production from his modern cutter.

CK's 3-bearing spindle and flywheel assured Maximum Cutter Efficiency. On this job, it meant fast metal removal and excellent finish in a single pass.

The new Kearney & Trecker CK milling machine on this job has 24 different spindle speeds (13 to 1300 rpm). Its 32 different table feeds range from ¾" to 90" per minute. Operator was able to pick proper *speed and feed* — to take full advantage of high horsepower and modern tools. The result — Greater Productivity on this job.

New 25hp No. 4 Model CK vertical

CK's new heavy duty (2" dia.) table feed screw gives greater bearing contact for smoother feed performance and sustained accuracy.



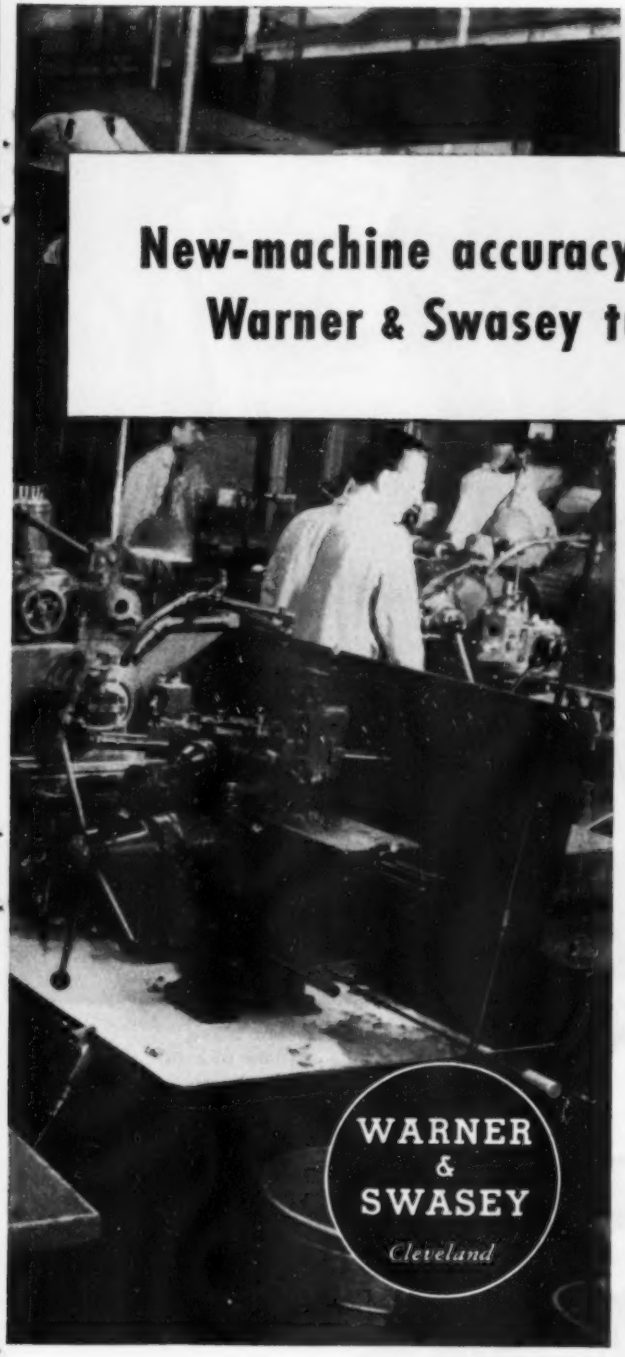
CK's positive lubrication plus generously proportioned gears and shafts assure cool, trouble-free operation under heaviest load conditions.

It will pay you to see the new CK line of milling machines — check them against your own requirements. You'll notice how every feature is designed and job-proven to give you cost-cutting results—greater machine capacity, productivity and better finished products. So, for the full story, contact your nearest Kearney & Trecker representative or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

Warner & Swasey Turret Lathes at Reeves Instrument Corporation, New York City

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER

New-machine accuracy from war-built Warner & Swasey turret lathes!



This story comes from the REEVES INSTRUMENT CORPORATION of New York City, a company manufacturing precision computers and instruments. Reeves tells us that they still maintain .0005" accuracy from eight Warner & Swasey No. 3, 4, and 5 Turret Lathes purchased during World War II!

If you will recall the almost unbelievable production of machine tools in those days, it might be quite natural to think there would have been some letdown in the accuracy built into those machines. But Reeves continues to produce vital instrument parts to rigid Air Force and Navy standards of precision on their war-built Warner & Swaseys.

Today, production history is repeating itself. We're turning out machines at a tremendous rate to fill the needs of defense plants and other manufacturers. But there has been—and will be—no letdown in the accuracy and dependability that is built into all Warner & Swaseys.

& SWASEY TURRET LATHES, AUTOMATICS, AND TAPPING MACHINES

MORSE
MORSE
MORSE

"MORSE TAPS?

Sure – how do you want 'em . . . straight flute . . . spiral flute . . . or spiral point?"

For regular shop practice, Morse Straight-Fluted Taps are the answer in most materials.

But on "stringy" ferrous materials where straight-fluted taps won't cut clean threads . . . get shear-cutting, Morse Spiral Pointed Taps that push the chips ahead and *out*.

And if those bulky, non-ferrous chips are hard to remove . . . then get Morse Spiral Fluted Taps that simplify chip removal problems by drawing the chips out of the hole.

All these three types of Morse Taps have ample rake angle to handle a wide variety of materials. And all are available in fractional or machine-screw sizes, with one or more chamfers. So see your Morse-Franchised Distributor today about the right Morse Taps for *your* work.

MORSE TWIST DRILL & MACHINE CO.
NEW BEDFORD, MASS.
(Div. of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

MORSE
Cutting Tools

LINK-BELT ball and roller

... keep company with America's hardest-

WHETHER it's a farm implement or an oil field drilling rig . . . construction equipment, textile machinery or any of scores of industry's hardest-working machines—America's top machine designers know they can rely on Link-Belt's complete line of industrial ball and roller bearings.

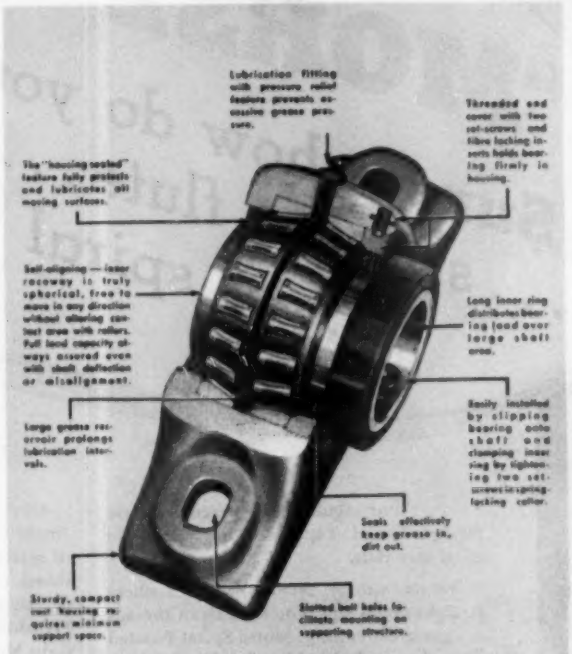
They've learned that mounting vital rotating parts on precision Link-Belt bearings assures longer machine life . . . greater freedom from wear, excessive lubrication and maintenance expense.

There are sound reasons for this universal acceptance. Foremost is quality. At Link-Belt, quality is no idle catchword. It's *real*—the result of continuing research . . . sound engineering . . . highest grade materials . . . skilled craftsmanship . . . rigid inspection.

Let a Link-Belt bearing specialist show you how this unvarying quality can step up your production efficiency and economy. Or you can get complete engineering information from Data Book 2550.

LINK-BELT

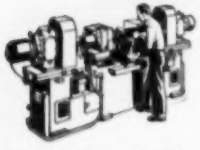
BALL and ROLLER BEARINGS


Lubrication fitting with pressure relief feature prevents excessive grease pressure.
Threaded end cover with two set-screws and fibre locking inserts holds bearing firmly in housing.
The "housing seated" feature fully protects and lubricates all moving surfaces.
Self-aligning — inner raceway is truly spherical, free to move in any direction without altering contact area with rollers. Full load capacity always assured even with shaft deflection or misalignment.
Long inner ring distributes bearing load over large shaft area.
Easily installed by slipping bearing onto shaft and clamping inner ring by tightening two set-screws in spring-locking collar.
Large grease reservoir prolongs lubrication intervals.
Seals effectively keep grease in, dirt out.
Sturdy, compact cast housing requires minimum support space.
Slotted bolt holes facilitate mounting on supporting structure.

Cutaway of Series 400 Roller Bearing Pillow Block—one of many types in the Link-Belt line of Pillow Blocks, Flanged, Flanged Cartridge, Cartridge, Hanger, Take-up Blocks and Unmounted Bearings.

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in Principal Cities.

LINK-BELT ball and roller bearings



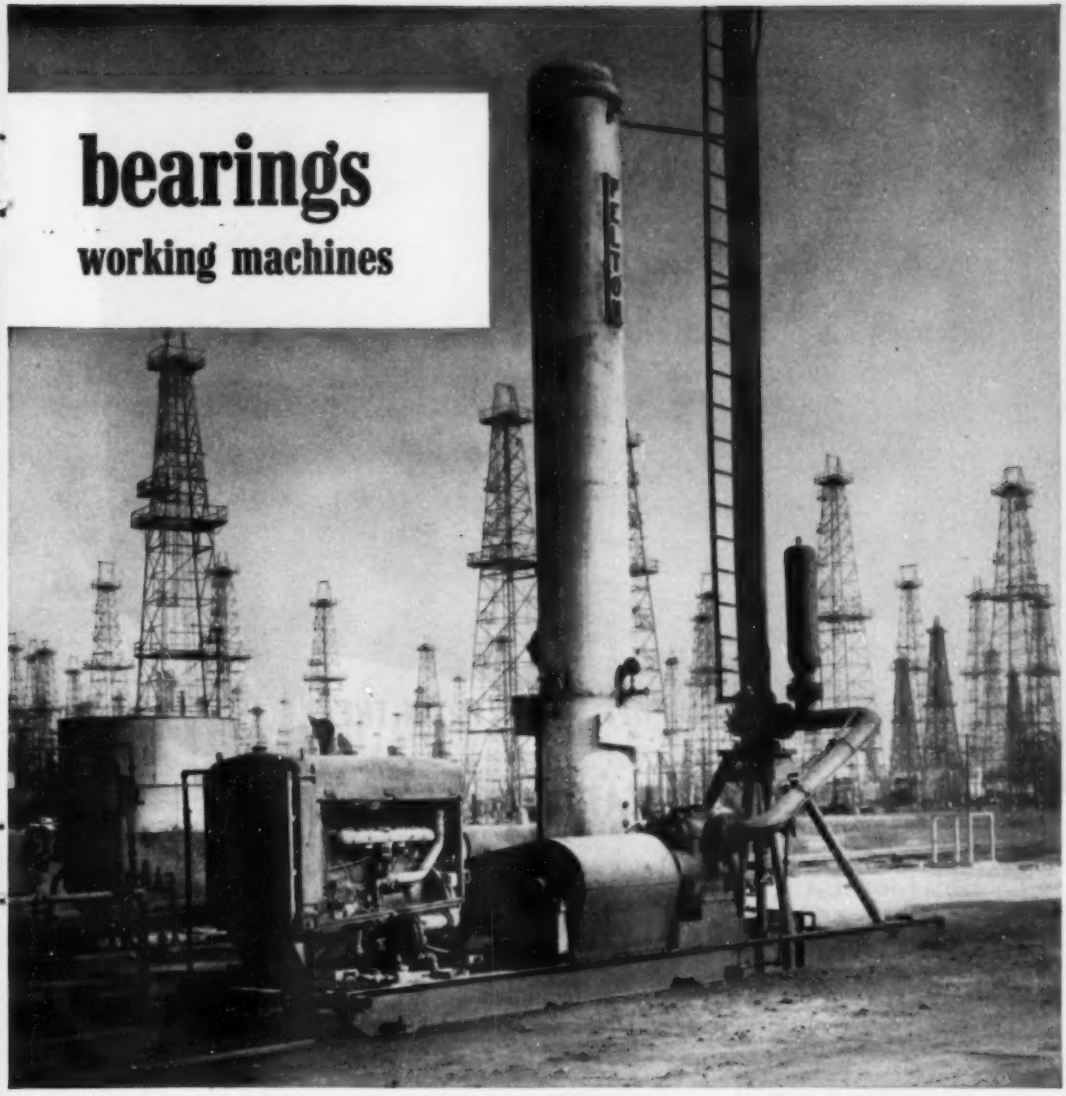
Metal Working Machinery

Farm Machinery

Construction Equipment

Textile Machines

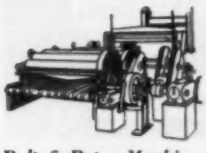
bearings
working machines



Pelton Oil Pumping Jack operates day in, day out—rain or shine—in oil fields. Rugged Link-Belt Series 6800-6900 Roller Bearing Pillow Blocks are used exclusively.

12,800

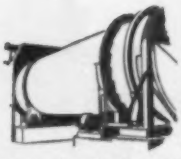
smooth the path of power for all industry



Pulp & Paper Machinery

Materials Handling Equipment

Oil Field Equipment



Processing Equipment

PUT IT ON THE BLANCHARD

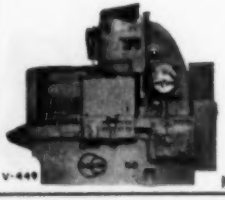
WHEN SPECIFICATIONS CALL FOR...

HEAVY STOCK REMOVAL — This steel block was torch-cut from a plate. It is 24 inches square and 6 inches thick. ⅛" of stock was removed from the broad surfaces, and ¼" from the 4 edges — a total of over 100 lbs.!

SPEED — A No. 18 Blanchard Surface Grinder, with extended column, ground this block on all 6 sides in only 6 hours.

ECONOMY — Not only did speed of stock removal roll up real savings, but the abrasive cost for the Blanchard Grinding Wheel, which was used for the job, figured less than 6 dollars.

CLOSE TOLERANCES — The block was held square in all directions to .002". Although this particular job calls for heavy stock removal, this same No. 18 Blanchard is fully capable of grinding to a dimension tolerance of ±.0001", a surface finish of 3 micro-inches, and flat within 3 light bands!



V-449

NO. 18 BLANCHARD SURFACE GRINDER

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE CO.

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

Harden all Tool Steel Vees

60 ROCKWELL C

protect the carriage ways of

"AMERICAN" PACEMAKER LATHES

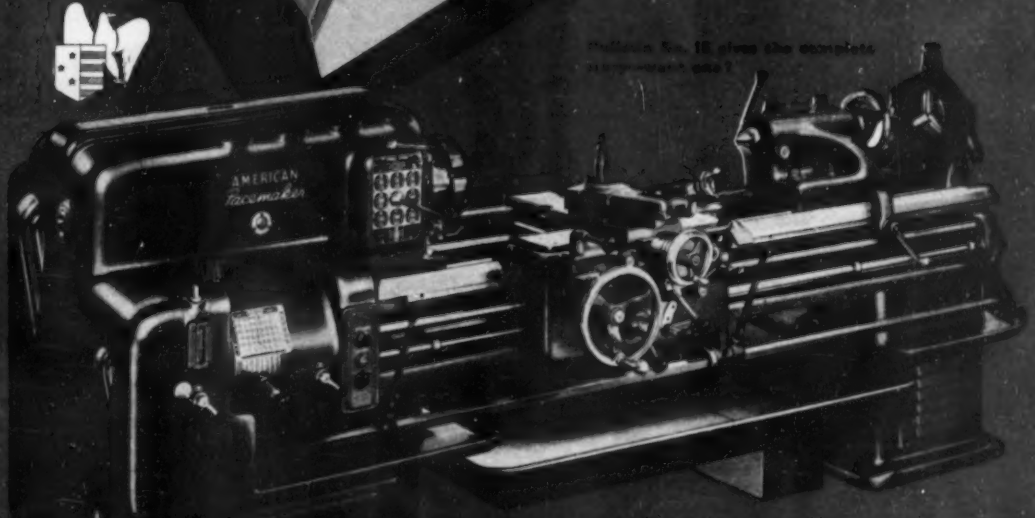
They are standard equipment on all "AMERICAN" Lathes

These hardened vees are made of solid tool steel and ground to gauge tolerances for interchangeability should replacements ever be required.

After hardening, the metallurgical structure is stabilized by cold treatment at minus 100° Fahrenheit to prevent subsequent warping.

This feature is but one of the outstanding advantages offered by the new "AMERICAN" Pacemaker Lathe.

Bulletin No. 15 gives the complete story—write for your copy today.



THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

LATHES AND RADIAL DRILLS

Versatility with a...

EXCEPTIONALLY SMOOTH HYDRAULIC TRAVERSE with independent right and left-hand dwell control — automatic wheel feed at each reversal.

INDIVIDUALLY POWERED INTERNAL SPINDLE permanently hinged to front of wheel slide for maximum convenience and rapid set-ups.

NORTON 10 x 20" UNIVERSAL GRINDER

Additional features are described in Catalog 170. Write for your copy today.

Making better products to make other products better

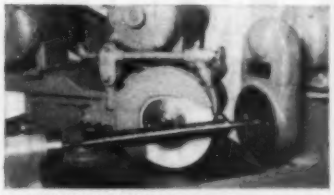
NORTON COMPANY, WORCESTER 6, MASS., U. S. A.

DISTRICT SALES OFFICES: HARTFORD • NEW YORK • CLEVELAND • CHICAGO • DETROIT

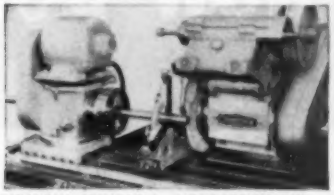
NORTON 10x20" UNIVERSAL GRINDER

simplified set-up . . . smooth performance

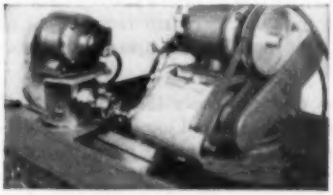
CONVENTIONAL or SPEED CHUCKS may be left permanently mounted on one end of headstock spindle. Headstock quickly swivelled 180° to bring chuck into position.



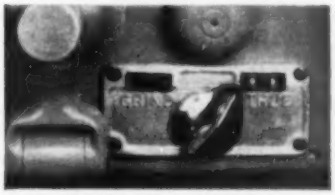
INTERCHANGEABILITY permits reversing head and footstock positions to eliminate necessity of changing wheel and drive to other end of spindle.



HOLLOW SPINDLE in HEADSTOCK allows work up to 1" in diameter (and which is longer than machine) to be passed clear through.



COMPOUND WHEEL SLIDE permits swivelling of wheel head to any angle and wheel feed at any angle.



PRESET TRUING SPEED CONTROL enables table speed settings to remain undisturbed during truing. Independent right and left-hand dwell controls.

The **versatility** of the NORTON 10 x 20" Universal Grinder goes beyond efficient performance of external, internal, face, and angular wheel feed grinding.

Head and footstock positions are interchangeable permitting simplified set-up on jobs involving shoulders or spacers. Set-ups are made easier on chucking jobs by the D1-3" camlock nose on one end of the headstock spindle which permits permanent chuck mounting. The chuck is quickly positioned by swivelling the headstock.

The headstock spindle is designed to take a workpiece up to 1" diameter clear through. This permits an extra long piece to be ground by chucking at one end and passing the remainder through.

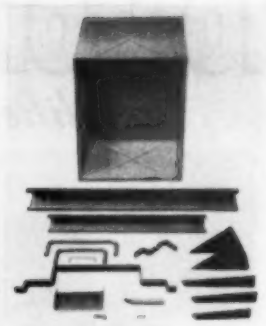
For ease of set-up, the internal spindle is a hinged-bracket type, attached to the front of the wheel slide. This spindle is quickly swung into position for internal grinding — or is as quickly swung out of the way.

The wide versatility of this machine demonstrates again how you economize when you modernize with a new NORTON Machine.

To Economize Modernize with NEW **NORTON** GRINDERS and LAPPERS

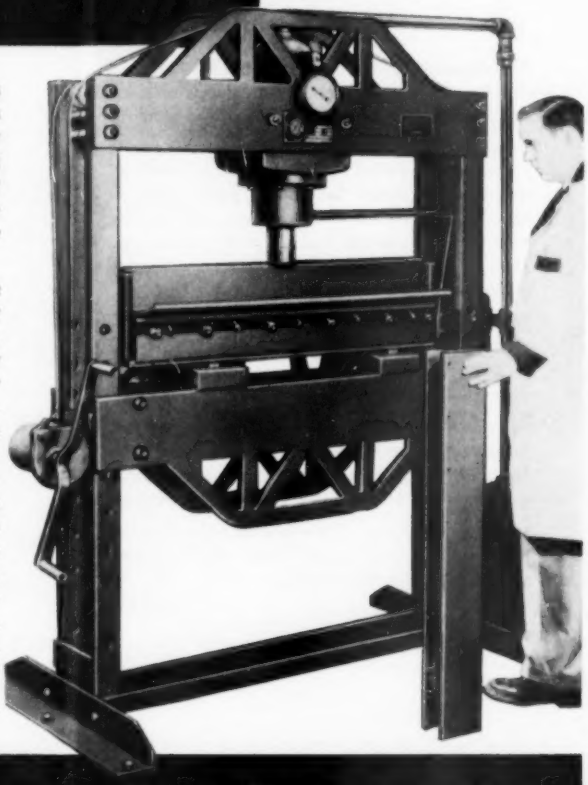
M608

KRW PRESS
BOUGHT FOR ONE JOB
NOW DOES 15!



Here's the line-up . . .

Gross Machinery Inc. of Buffalo, N. Y., makers of dry cleaning equipment, forms all these parts on their KRW Hydraulic press. Each one used to be a slow, inaccurate hand or power brake job.



Gross Machinery originally bought this 75 ton KRW motor driven hydraulic press to form cylinder ribs of 14 gauge steel for their dry cleaning tumblers (second and third from top in photo above). Formerly made by hand, each rib required 12 minutes to form. Now the press does the *same job in* $1\frac{1}{2}$ *minutes.*

But that was only the beginning. The press soon began poking its nose into every problem in the plant. It gave them a 50% increase in production of filter plates for their tumblers. The lint-collecting drawer (at top in photo above) used to rattle. Gross had almost decided to make these drawers out of heavier gauge, more expensive steel. But then they found that criss-cross ribs formed by their KRW press eliminated the trouble. Brackets for the tumblers, corner inserts for the tumbler hoods, clips for holding wire and tubing on the tumbler — all these jobs are now made faster, more accurately on this versatile KRW press. Earl Westphal, general production superintendent at Gross, says: *"We bought this press late in* 1950 *and it's paid for itself ten times over."*

Bring your pressing problems to K. R. Wilson. We have a full line, 25 to 150 ton capacities, hand operated, air operated or motor driven presses. Write for facts, prices and delivery dates. Dept. 11.

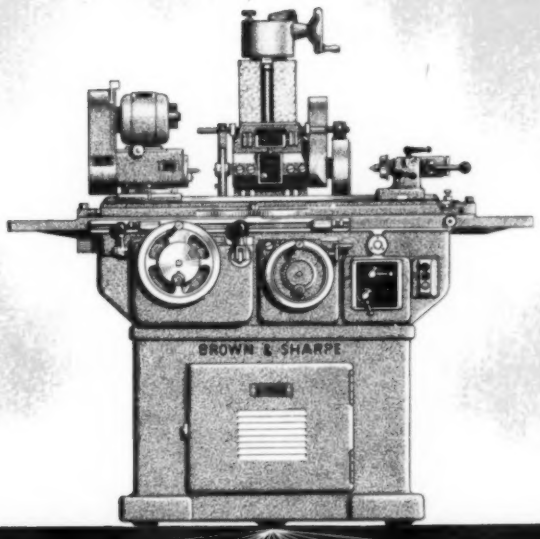
K. R. WILSON

215 MAIN STREET • BUFFALO 3, NEW YORK

B·S

Productioneered

Equipment for Toolroom Grinding



With today's heavier production demanding more and faster tool sharpening and other regular toolroom grinding jobs, there is a constant risk of toolroom "bottlenecks". That is where Brown & Sharpe Machines and Tools can help. This modern equipment is especially designed with broad aspects of plant production in mind . . . *"Productioneered"* with simplicity, flexibility and lasting accuracy to keep production flowing continuously.

B·S *Productioneered*

for complete cutter and tool grinding service

NO.10N CUTTER AND TOOL GRINDING MACHINE

WITH UNIVERSAL OR PLAIN EQUIPMENT

The No.10N with Universal Equipment (illustrated) is a fast, accurate machine for complete cutter and tool sharpening, plus light cylindrical, internal and surface grinding. Roller-bearing table and simple, convenient controls are typical of many easy-handling features. The same basic machine with Plain Equipment provides equally high performance for cutter and tool sharpening only.

Brown & Sharpe

B·S *Productioneered*

for unusually broad utility

No.13 UNIVERSAL AND TOOL GRINDING MACHINE

Most versatile of the Brown & Sharpe grinding machines, this model is designed primarily for broad utility in the toolroom — but can also be speedily set up to care for limited over-flow of manufacturing work.

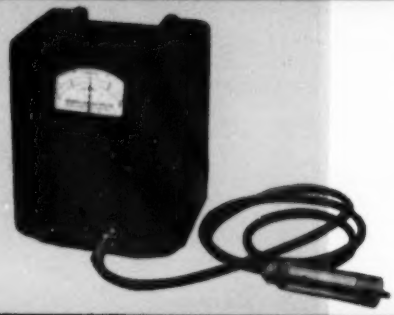
No.5 CUTTER AND TOOL GRINDING MACHINE

Especially designed for fast, efficient sharpening of cutters and tools — particularly smaller cutters and end mills. Additional equipment is available to further speedup sharpening in quantity.

B·S *Productioneered*

for quick sharpening of tools and cutters

B·S Productioneered to expedite high level output

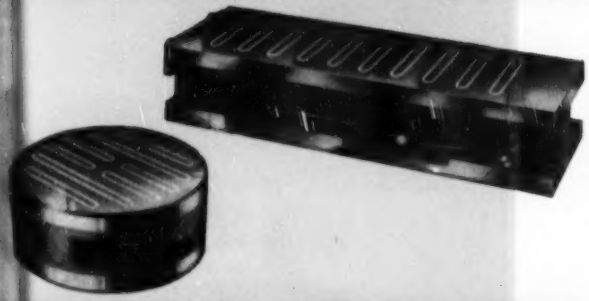


ELECTRONIC MEASURING EQUIPMENT

This Brown & Sharpe Electronic Equipment permits precision gaging and inspection, at high speed, with human error practically eliminated.

It amplifies gage measurements 1800 to 18,000 times, enables operators to read ten-thousandths as easily as inches, as fast as parts can be handled. Invaluable in maintaining uniform quality at high output.

B·S Productioneered to save operators' time



PERMANENT MAGNET CHUCKS

Brown & Sharpe Permanent Magnet Chucks make the most of the skilled machinist's time by simplifying work-holding problems. A quick shift of a lever engages or disengages magnetic holding power. No electrical connections, no operating cost, nothing to cause heating. Clamps, vises, jigs and fixtures eliminated for many jobs. Wide variety of rectangular and rotary models available.

B·S Productioneered as aids to higher output

BROWN & SHARPE VISES

Brown & Sharpe Vises promote fast production through the quick, accurate setting and secure holding of precision work for milling, grinding or drilling — often eliminating the need for expensive jigs or fixtures. Made in Plain, Flanged, Swivel, Cam and Toolmakers' types.

WRITE FOR COMPLETE INFORMATION ON ANY OF THE BROWN & SHARPE PRODUCTS LISTED BELOW

WE URGE BUYING THROUGH THE DISTRIBUTOR

Brown & Sharpe B·S

Milling Machines • Grinding Machines • Screw Machines • Cutters • Machine Tool Accessories
Machinists' Tools • Johansson Gage Blocks • Electronic Measuring Equipment • Permanent Magnet Chucks • Pumps

BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U. S. A.

PRINTED IN U. S. A.

HARDINGE
ELMIRA, N.Y.

TOOLING For PRODUCTION

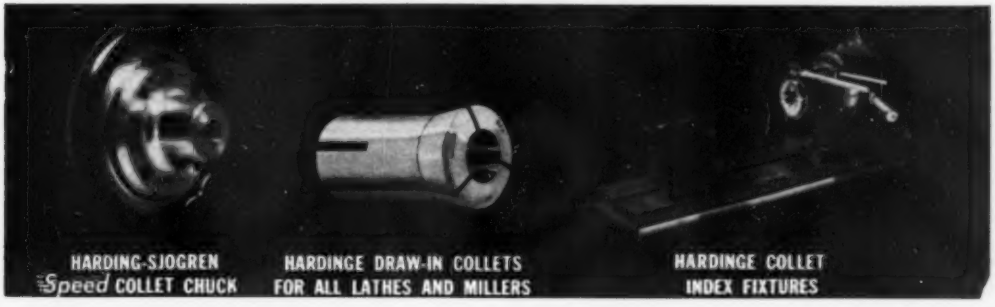
STANDARD EQUIPMENT in
Progressive Screw
Machine Plants

Style "S" Master Collets and Pads

Style "B" Master Feed Fingers and Pads

A.S.T.E. SPACE 1516

See the **only** Master Collet with no work pressure on the screw. Pads are interchangeable among different makes of automatics. Also included will be the complete line of Hardinge Collets and Feed Fingers for all makes of Automatics, Chucking Machines and Turret Lathes.



HARDING-SJOGREN *Speed* COLLET CHUCK

HARDINGE DRAW-IN COLLETS FOR ALL LATHES AND MILLERS

HARDINGE COLLET INDEX FIXTURES

What are the new developments in Tool Grinding?

...you'll know when you visit the exhibit

by CARBO

TRADE

"Carborundum" is a registered trademark of The Carborundum Company, Niagara Falls, N. Y.

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at the ASTE TOOL SHOW

CHICAGO • MARCH 17 thru 21

Booths 1326 and 1330

● If you have to miss the show . . . get the news of the latest from your CARBORUNDUM Salesman or Distributor

Bridgeport

TURRET MILLING MACHINES

continue to make other methods obsolete

NO matter how you figure it, today's work cannot be handled economically on yesterday's machines and old-fashioned tooling. . . . In terms of speed, accuracy, convenience and costs, obsolete methods are a liability . . . never an asset.

How are your machines dated . . . '52 . . . '42 . . . '32 . . . or what? Can you mill, drill, bore or shape . . . at all angles of the work . . . without changing set up?

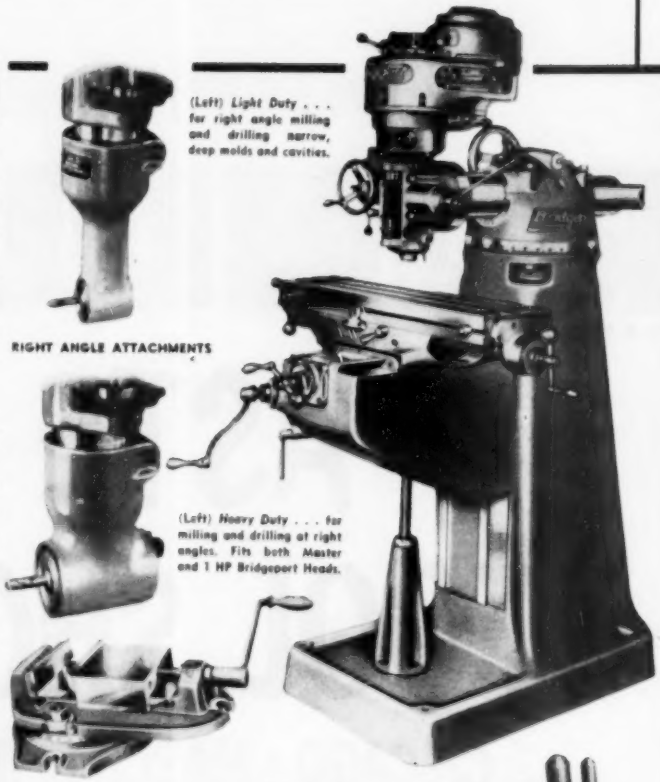
We suggest you investigate the advantages offered by "BRIDGEPORTS" and compare the possibilities with what you are trying to accomplish on existing equipment. Once you've done this, you'll do what countless other shops are doing . . . and replace obsolete machine tools with modern, proved BRIDGEPORT TURRET MILLING MACHINES.

●

RIGHT ANGLE ATTACHMENTS

(Left) *Light Duty* . . . for right angle milling and drilling narrow, deep molds and cavities.

(Left) *Heavy Duty* . . . for milling and drilling at right angles. Fits both Master and 1 HP Bridgeport Heads.

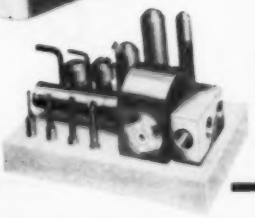


Condensed Specifications

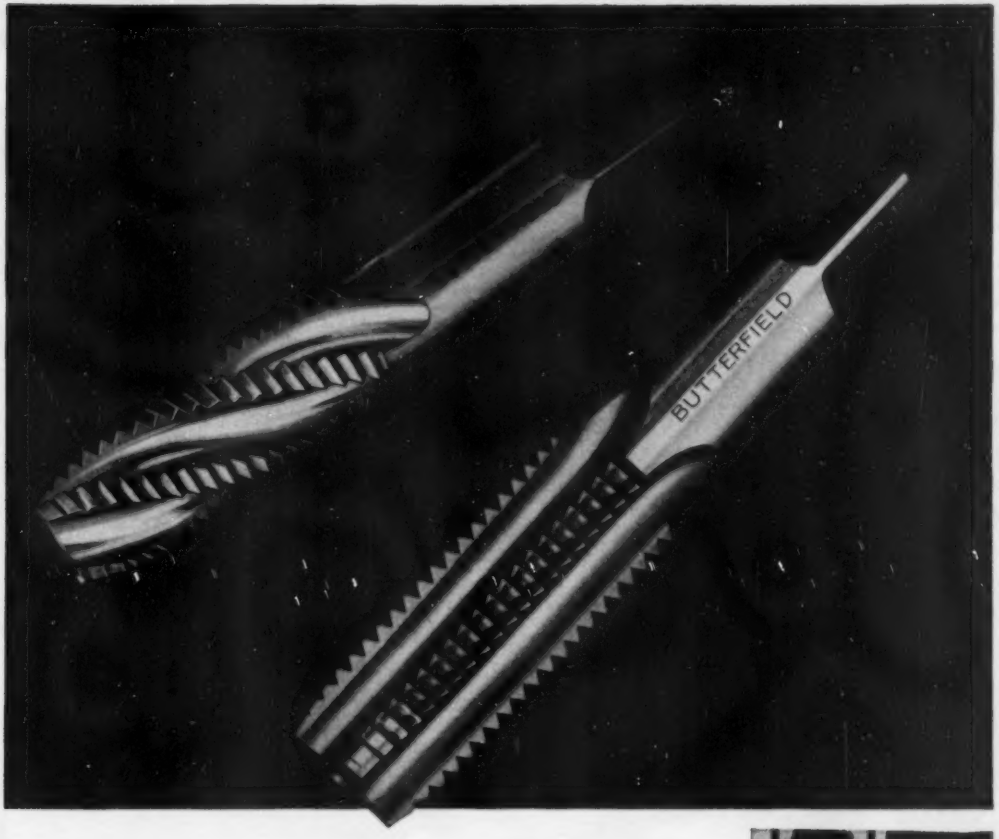
- 8 Spindle Speeds . . . from 80 to 2720 RPM.
- Back Geared Spindle Drive Unit: utilizes full power at all speeds without belt slippage.
- Power Feed to Quill: 3 steps . . . .0015, .003 and .006 in. per spindle revolution.
- Quill Travel: 5".
- Spindle Brake and Lock for convenience in changing tools.
- Collet Capacity: up to ¾" diam.

MILLING MACHINE VISE
An improved vise providing great gripping power. Streamlined for attractiveness and equipped with coolant trough. Rigid holding through screw of large diameter. Made in two sizes: 5"x3½" and 6"x5" jaw openings.

NO. 2 BORING HEAD
Boring Tools and Holder provide the means of boring holes up to 6" diameter. Available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.



Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines



THEY BRING ASSURED ACCURACY TO YOUR TAPPING JOBS

With Butterfield Taps you eliminate all risk of getting a defective tap that has been overlooked in ordinary factory spot-checking.

Each Butterfield Tap is individually inspected to make sure it will do a fast, clean, trouble-free job of threading.

That's why continued use of these 100% inspected tools is a long range policy that pays off in smoother, more economical production.

In the complete Butterfield line there's a tap for best results in every tapping application, in every material. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont. *In Canada:* Rock Island, Quebec.

INSPECTOR checks thread form and lead on a Hartness Comparator that magnifies 62½ diameters. Part of Butterfield's 100% inspection.

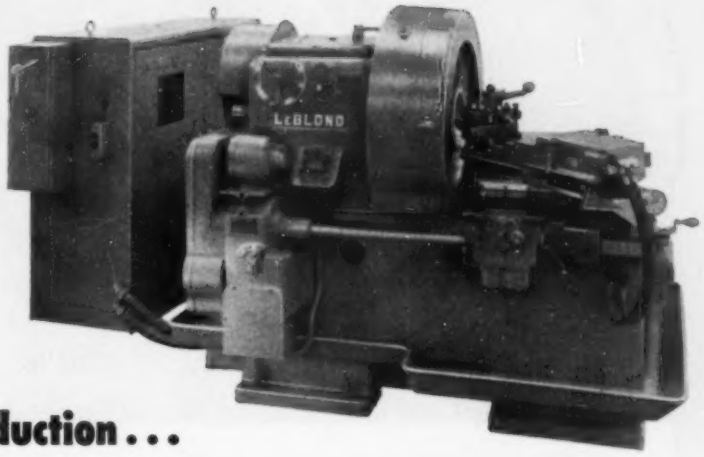
Hand Taps • Machine Screw Taps • Pipe Taps
Stove Bolt Taps • Pulley Taps
Staybolt Taps • Boiler Taps • Nut Taps
Serial Taps • Mud or Washout Taps

SEE YOUR NEARBY BUTTERFIELD DISTRIBUTOR FOR PROMPT DELIVERIES AND SERVICE

BUTTERFIELD
THE 100% INSPECTED TOOLS
Every Tool Individually Inspected
TAPS • DIES • REAMERS • SCREW PLATES

ANNOUNCING THE NEW LEBLOND

CONTOUR FACING LATHE!



Now in full production . . .

Automatically faces jet engine turbine wheel discs . . .

New design from the ground up.

High-speed automatic contour facing, semi-finish or finish.

Flexible, with ready accessibility for changeover from one disc to another.

For either steel or aluminum.

Fully automatic cycle to center *or* across center.

Automatically-controlled constant cutting speed.

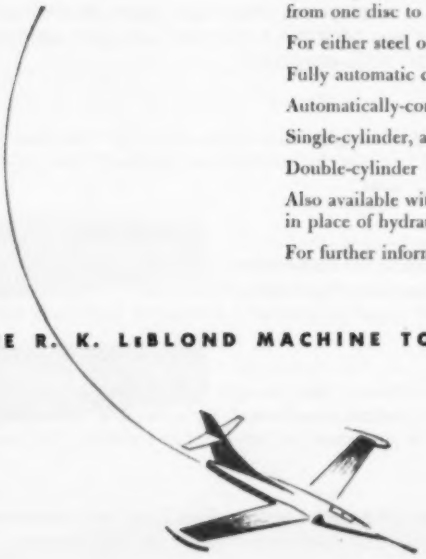
Single-cylinder, adjustable-angle Hydra-Trace for simple discs.

Double-cylinder tracer for complicated discs.

Also available with power angular feed compound rest in place of hydraulic tracing unit.

For further information write . . .

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO



LeBLOND of Cincinnati

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 64 YEARS*

Distinction

. . . because of specialization

Some typical performance examples of
HIGH SPEED STEELS by VANADIUM-ALLOYS
complete details furnished gladly on request

Vasco M-2

In an exhaustive test against other high speed steels of the *same analysis*, Vasco M-2 drills produced 1.4 times as many holes as the other drills employed.

Red Cut Superior

Trimming dies for hexagon head bolts of S.A.E. 1020 steel are giving up to 3.1 times the production obtained from 18-4-1 steels previously used.

Van Cut

In broaching turbine bucket retainer discs made of nickel-chrome-moly heat resisting alloy steel, this new high speed grade gave twice the performance obtained from 18-4-2 broaches previously used.

8-N-2

A leading Tool Maker has selected 8-N-2 over competitive grades for an important line of small tools because tests proved its superiority for uniformity of hardness and cutting efficiency.

Van-Lom

In hot forming 5/8" railroad spikes, Van-Lom out-produces a competitive steel of *identical analysis* by 40 per cent.

Brands in Manufacture Performance

in First Quality Tool and Die Steels, exclusively!

More than 40 years of concentration upon production of the finest in tool steels have taught us much that is not in the books. The technical data published by our Research Department is perhaps the most extensive in the industry—but our manufacturing practices are distinctively our own. • EVERY BRAND NAME of Vanadium-Alloys' signifies performance for the user that goes beyond the chemical composition of the steel . . . extra performance that is created by exacting, specialized manufacturing techniques. • The end-result is greater profit for the customer, proved by realistic comparison. Buy your High Speed Steels by brand—and let us show you why the right brands for your operations are made by Vanadium-Alloys Steel Company.

Vasco Suprême

Form cutters produced 9,156 ball races per grind from S.A.E. 52100 steel compared to 3,055 pieces per grind from competing cobalt high speed steel.

Neatro

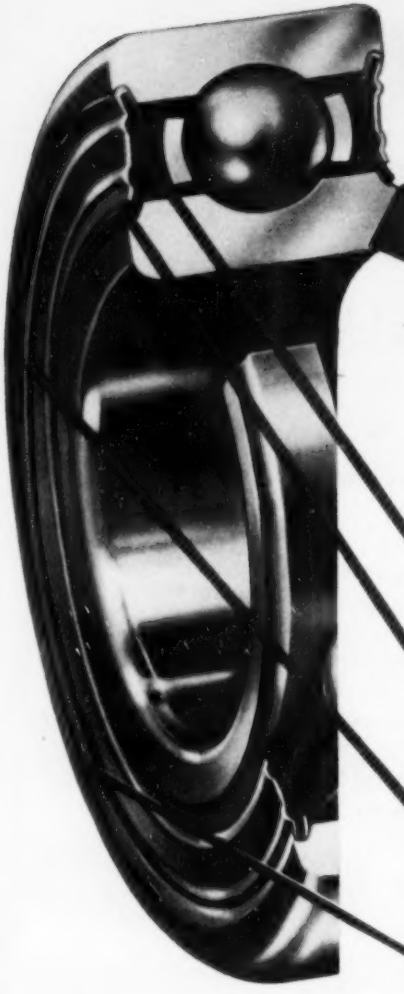
48 forged and heat treated automotive crankshafts machined per grind compared to 36 crankshafts produced by a steel of the closest competitive analysis.

Vanadium-Alloys

STEEL COMPANY

LATROBE, PENNA.

COLONIAL STEEL DIVISION ANCHOR DRAWN STEEL CO.



Seals OUT

SKF Red

YOU CAN SEE WHY - - -

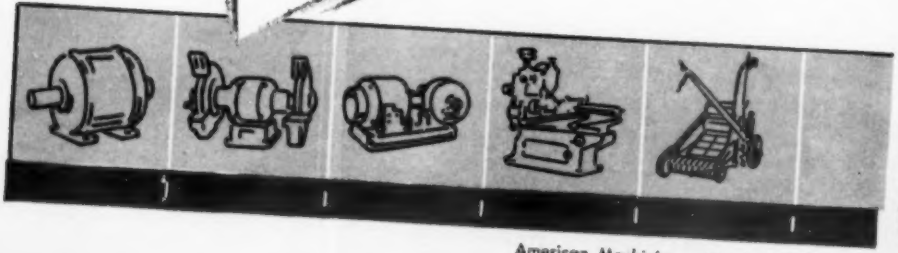
1 Seal is stable DuPont Fairprene, unaffected by petroleum-base lubricants, normal operating temperatures, or ageing.

2 Seal, extending below steel retaining ring, forms a flexible lip which lightly touches a smooth, uniform chamfer of the inner ring. This exclusive design provides effective sealing with extremely light contact, hence low friction.

3 Circular-formed ribs around the retaining rings provide great rigidity. Thus, seal contact can be light, yet certain under all operating conditions.

4 Retaining ring is staked securely during manufacture—stays put for the life of the bearing.

5 Lubricated at the factory.



TROUBLE!

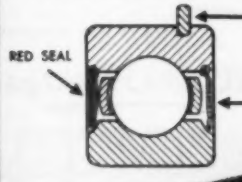
Seal bearings

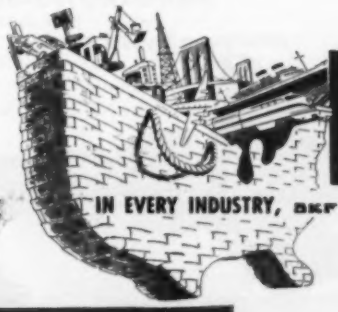
PROVED IN SERVICE - - -

Machine designers know they are competitively priced—all are standard single-row SAE widths—all are interchangeable with conventional non-sealed bearings. Proved in service by manufacturers of electric motors, portable tools, household appliances, and other machinery where the bearings must be efficiently sealed to keep dirt out—and lubricant in. Because SKF pioneered in the sealed-bearing field—the first to incorporate effective seals within the standard SAE width bearing—designers have come to depend on this store of engineering knowledge built into each Red Seal Bearing. They know, too, that the team-work of SKF field-engineers and design-engineers at SKF's headquarters are theirs for the asking.

Write **SKF INDUSTRIES, INC.**, PHILADELPHIA 32, PA.—*manufacturers of* SKF *and* HESS-BRIGHT *bearings.*

RED SEALS ARE ALSO AVAILABLE WITH SNAP RINGS AND METAL SHIELDS—ANY COMBINATION OF THESE THREE FEATURES ARE AVAILABLE





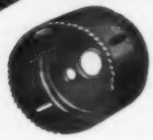
SKF
BALL AND ROLLER BEARINGS

IN EVERY INDUSTRY, SKF Puts The Right Bearing In The Right Place

Cut...

LARGE HOLES

. . . thru any machineable material up to 1 1/8 *INCHES* thick!



Here is a premium tool which makes it possible to saw holes in one short operation . . . large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from 3/4" to 4 1/2". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-650

"MARVEL" has Always had the edge!

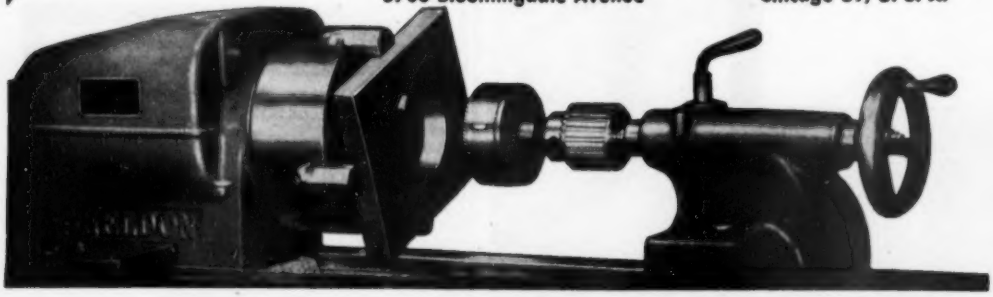
MARVEL Metal Cutting SAWS

Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Avenue **Chicago 39, U. S. A.**



Here's Another Cimcool Booster!

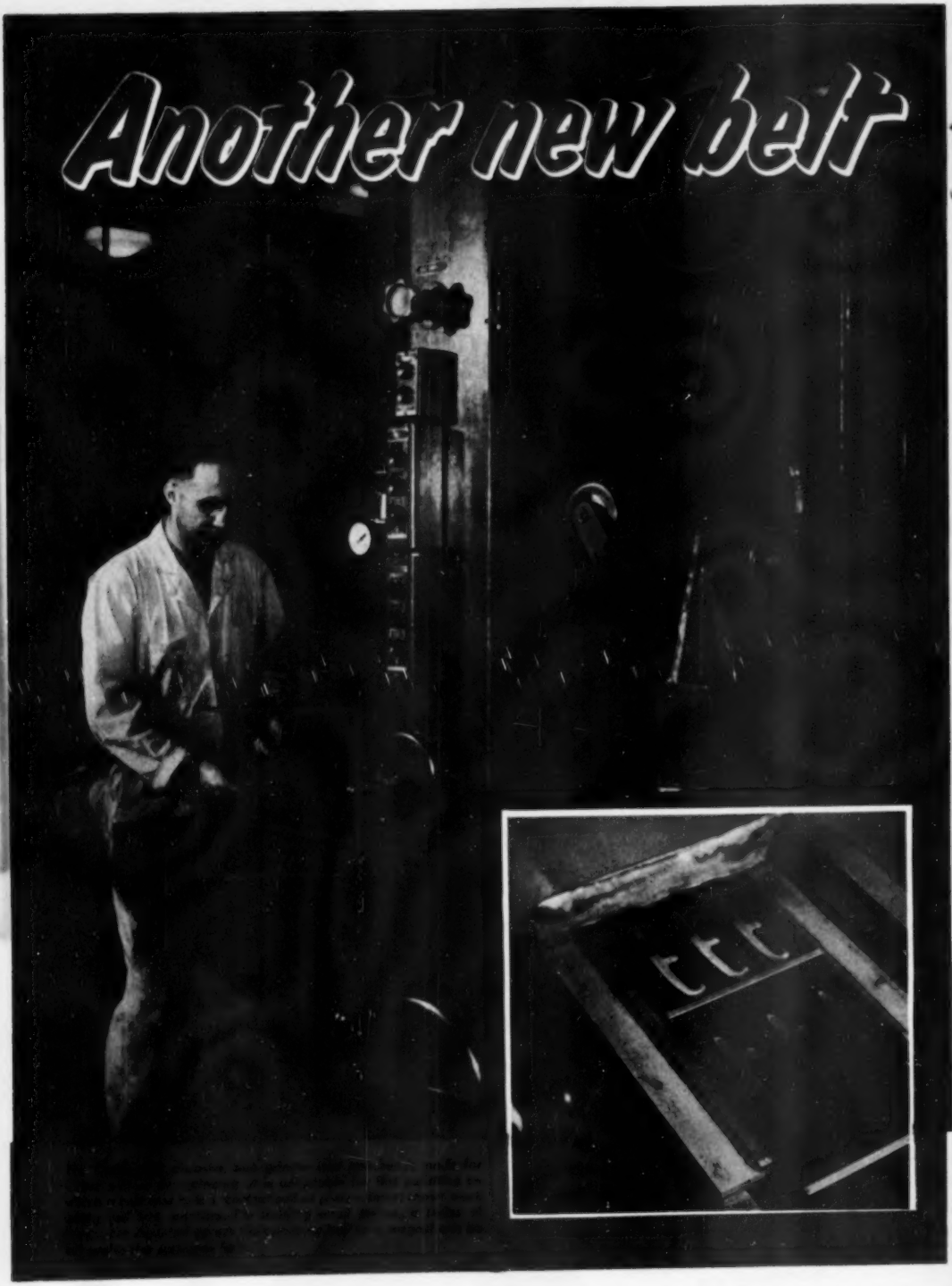
Naturally Cimcool® gets a rousing cheer from housewives on washday. Because this radically new and different cutting fluid *doesn't soil clothes!*

And that's just *one* of the many reasons why workers prefer Cimcool. It can't smoke. Can't burn. Doesn't soil hands. Contains no skin irritants. Leaves no dangerous slippery film on machine, work or floor. Virtually eliminates rancidity and foul odors. And, unlike old-fashioned cutting fluids, Cimcool is so effective that work and tools really stay cool to the touch.

You'll appreciate Cimcool, too, when you see how this chemical emulsion takes over 85% of all metal cutting operations. For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "CIMCOOL Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

Another new belt



finishing short-cut

...WITH

BEHR-MANNING abrasive belts

■ And that's plenty fast in this Curtis conveyor grinder and polisher. Light sheet metal parts zip through at speeds up to 40 feet per minute. Half way through, they meet a fast-moving, quick-cutting Behr-Manning abrasive belt. In a split second this belt removes tool marks, leaving a uniform surface easily polished by succeeding grits.

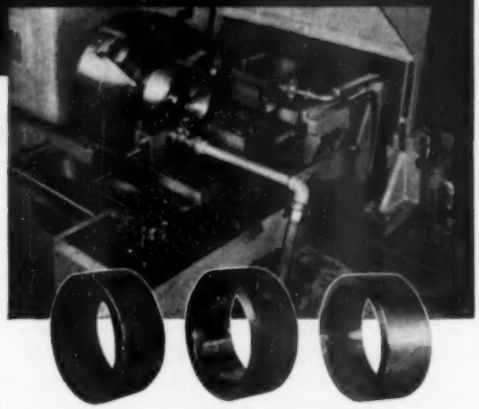
Here's a machine that symbolizes the speed and cost-cutting factors of mass production. It is also representative of the many new developments in belt-grinding and polishing procedures; in many cases worked out in cooperation with Behr-Manning Abrasives Engineers. Check with your Behr-Manning representative —he'll keep you up to date on the latest belt-finishing short cuts.

No better belt is made for assembly-line production speed and economy. Every grain is anchored sharp-end up... by the Behr-Manning patented Electro-coating method ...and that's the way they stay! Special DURABONDED® process secures the grit in a double grip— keeps them in cutting position even when the going gets hot and heavy.

NEW INFORMATION
....on coated abrasive grinding and polishing tools and methods. For your free copy, write to Behr-Manning, Troy, New York or for export, Norton Behr-Manning Overseas, Inc., U. S. A., New Rochelle, N. Y. Address Dept. AM-3.

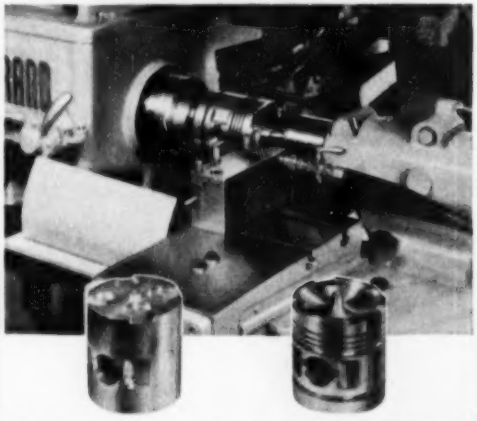
BEHR-MANNING

How to Get More Turning Production On Jobs Like These . . .



① SMALL LOT TURNING

Ten different bearings of both plain roller and ball type are turned on this Sundstrand Model 12A Automatic Lathe. Both inner and outer bearing races are rough and finish turned, bored, faced and chamfered in four set-ups. Universal tool blocks are used in performing all operations. Simplicity of set-up makes changeover easy and fast. Production time was reduced as much as 15 minutes per part over former method.



② LONG RUN TURNING

This Sundstrand Model 8A Automatic Lathe turns the O.D., faces the ends and cuts the grooves on aluminum pistons in rough and finish operations.

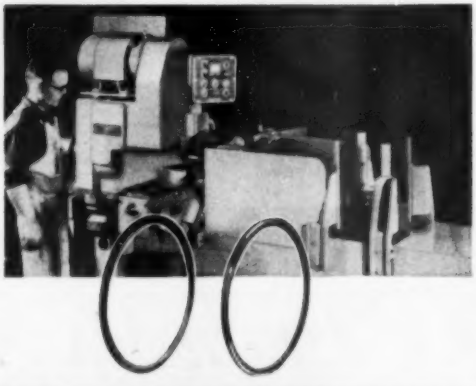
Front, rear and overhead slides operate simultaneously. Tools on front slide turn the O.D. while tools on cross-feeding rear slide cut the grooves. A single tool carried on the vertically feeding overhead slide attachment faces the concave end of piston.

Production is 90 pistons per hour for either the roughing or finishing operation.

SPECIAL TURNING ③

Here is a special Sundstrand Automatic Lathe designed for high production in facing one side of flywheel ring gears. Automatic ejection and hopper loading has been provided so that operator's only duty is to keep hopper filled with parts.

The fast cutting cycle, fast unloading and reloading combine to produce 165 machined pieces per hour.



SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

Design Features of SUNDSTRAND Automatic Lathes That Make This Production Possible

● Greater Horsepower

All new Sundstrand Automatic Lathes have been redesigned for greater rigidity and larger spindle drive motors. They have ample power for use of carbide cutting tools and are capable of doing more work.

● Wider Speed Range

Spindle speed range ratios have been increased to 30 to 1 to obtain maximum in cutting efficiency over a wider range of sizes of parts and material. The spindle unit is equipped with two driving gear centers, which increase the range between high and low spindle speeds. In addition, four speed changes can be obtained from one set of gears instead of the usual two.

● Wider Feed Range

A wider feed range has been provided to enable the handling of a greater range of parts and materials at maximum cutting efficiency. The New Models 4A, 8A, and 12A have a ratio of 18 to 1 between high and low feeds — Model 16 has an even greater range.

● Greater Carriage Adjustment

Both front and rear carriage of the latest Sundstrand Automatic Lathes are adjustable full length between headstock and tailstock centers — another important new feature.

● Faster Set-Up

Convenient location of pick-off gears for changing spindle speeds and front and rear carriage feeds is provided. Feed and speed chart and pick-off gear storage compartment are readily accessible for quick set-up or changeover.

● Quick Cycle Changeover

Complete control of all cycles is provided by adjustment of dogs on a disk. Making cams is eliminated. Changing position of dogs on disk changes length of rapid approach, feed and rapid return strokes — enables operator to set up cycle quickly and change over from one job to another easily.

● Automatic De-Clutching

All new models have been provided with automatic declutching between spindle and spindle motor with self-adjusting magnetic clutch and brake for quick stopping of spindle rotation.

● Screw Feed to Front Carriage

All new Sundstrand Automatic Lathes have screw instead of rack feed to the front carriage — resulting in fine finish and long tool life.

4 Models Cover HP Range of 3 to 75 HP

	MODEL 4A	MODEL 8A	MODEL 12A	MODEL 16
SPINDLE MOTOR	3 to 10 HP	10 to 25 HP	20 to 50 HP	50 to 75 HP
SPEED RANGE (Type A) (Type B)	60 to 1800 RPM 120 to 3600 RPM	40 to 1200 RPM 80 to 2400 RPM	30 to 900 RPM 60 to 1800 RPM	15 to 750 RPM
FEED RANGE	.003 to .048 IPR.	.004 to .070 IPR	.004 to .070 IPR	.0025 to .100 IPR
FRONT CARRIAGE: Longitudinal feed with angular feed-in, max. Swing over cross slide, max. Rapid traverse rate	 5" 8¾" 275"	 6" 12½" 250"	 8" 15¼" 250"	 12" 17" 250"
REAR SLIDE: Max. Stroke	4"	5½"	6½"	8"
LENGTH BETWEEN CENTERS	15, 24 & 36"	24, 36, 48 & 60".	24, 36, 48 & 60"	36, 60 & 84"

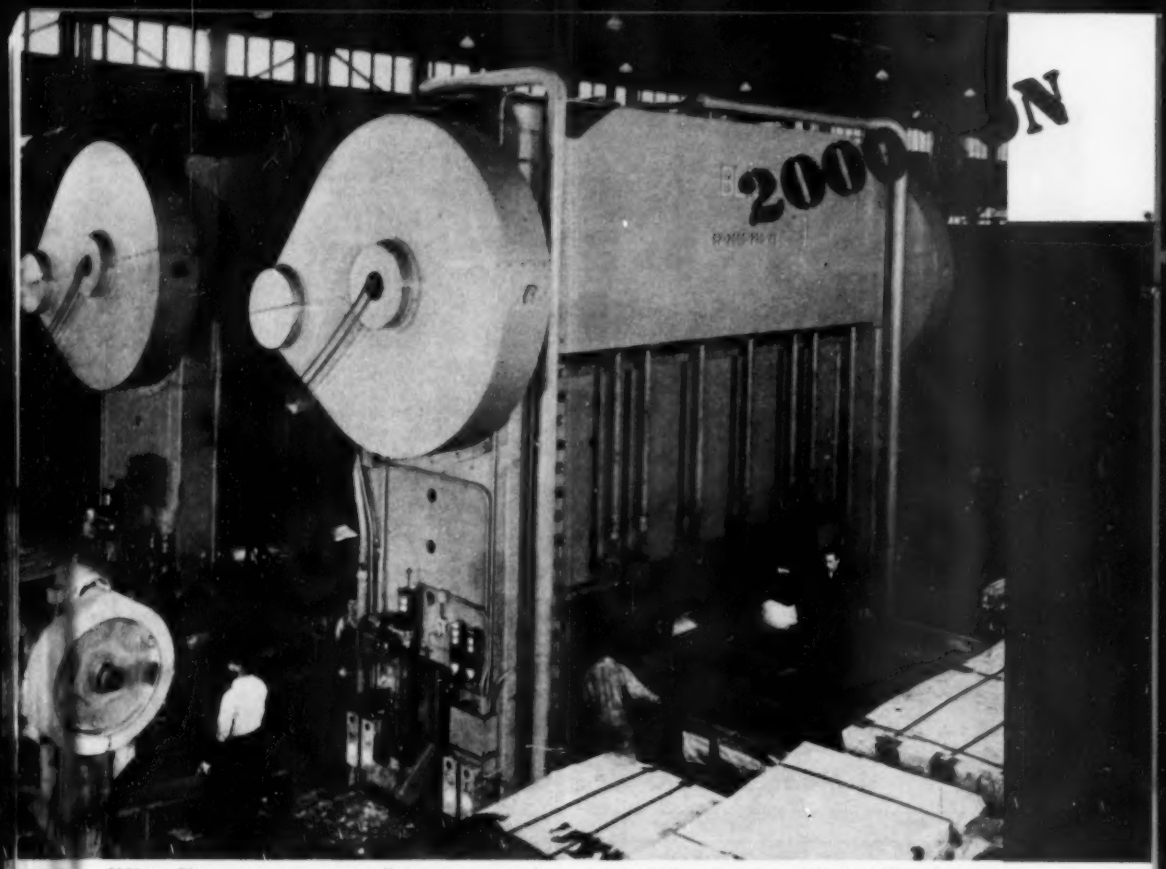
FREE ADDITIONAL DATA

The complete new line of Sundstrand Automatic Lathes includes the Models 4A, 8A, 12A and 16 ranging from 3 to 75 HP. Write for complete information on these new machines today. Ask for bulletin 117.

SUNDSTRAND

SUNDSTRAND
Machine Tool Company
2533 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES



2000-ton Bliss presses, recently installed, form and trim heavy rails at the Dearborn plant of the Ford Motor Company.

New Bliss Heavy-Tonnage Presses Join Ford Production Lines

Ford production lines' ever-increasing efficiency and reliability are no accident. They embody intensive studies of advanced equipment and techniques—especially in heavy-tonnage forming where improvement gives substantial savings. A case in point is the *new rail press line*—five Bliss 2000-ton presses recently installed by Ford.

Unusual design features provide capacity to spare and protection against downtime even with steady 'round-the-clock operation:

- Extra-deep crown, bed and slide members minimize deflection
- Crankshaft construction withstands most severely unbalanced loads
- Crankshaft jointed at center; simplifies maintenance, cuts down on floor area needed
- Twin pinions and intermediate gears distribute load on intermediate shafts
- Oversize crankshaft, clutch and brake reduce possibility of downtime

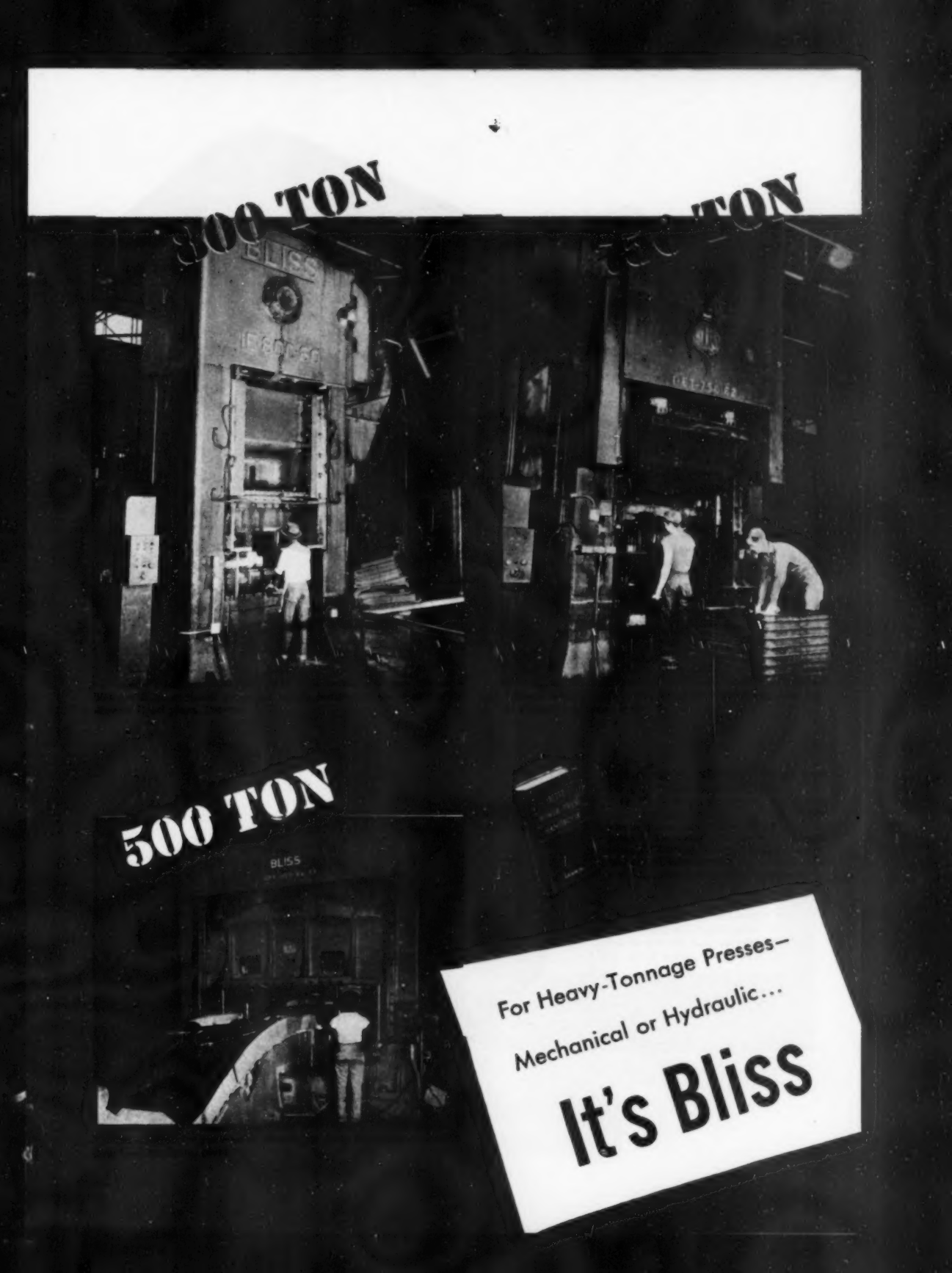
These design highlights show how Bliss' creative press engineering is applied to particular metal forming operations. You can get Bliss started on *your* special press engineering by calling your local Bliss representative. Virtually a production counselor for metal stampings, he is your liaison with Bliss' engineering staff, can recommend equipment and methods ...advise you on production rates and costs.

E. W. BLISS COMPANY, CANTON, OHIO

E. W. Bliss (England) Ltd., Derby, England

E. W. Bliss Company (Paris), St. Ouen sur Seine, France

Presses, Rolling Mills, Special Machinery


300 TON
BLISS
500 TON
BLISS
For Heavy-Tonnage Presses—
Mechanical or Hydraulic...
It's Bliss

Murderous shock duty is imposed on the motor on this log barker. Conventional cast motors broke shafts, feet, brackets. The steel frame Life-Line stands up . . . has reduced outages to zero . . . saved costly replacement.

Other makes of starters, previously tried, couldn't "stand the gaff" on this cinder block-making machine. Here, where vibration is severe, standard Life-Linestarters performed without fail. Operation requires opening and closing of starter over 240 times every hour.

Jarred?

These two can take slam-bang abuse

How many times does your design call for something extra in a control . . . or a motor? Extra ability to withstand vibration, shock, physical impact, for example. Here's a pair—matched in ability to meet these conditions.

Take the Life-Linestarter.® Vibration or accidental impact does not cause false operation with resultant contact pitting. That's because it employs an inverted, clapper-type design in which a movable element is pulled against a stationary magnet. Contact opening does not depend on gravity. Positive kickout spring speeds operation.

Now, the Life-Line motor. The severe stresses of heavy loads which must be transmitted through the motor frame and feet are easily withstood by the Life-Line steel frame. There's no distortion of laminations. What's more, steel adds strength without adding bulkiness. In fact, Life-Lines are as much as ⅓ smaller for the same frame size. You save space, weight; you gain strength.

Remember it costs no more to get Life-Line performance. Specify this pair on your future designs. More information? Simply call your Westinghouse representative. He'll give you complete facts . . . help you with any problems. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21636

YOU CAN BE SURE . . . IF IT'S

Westinghouse

Life-Line

MOTORS and CONTROLS

DO BETTER CARBIDE with Sterling's

THE STERLING GRINDING WHE
OF THE CLEVELAND

TOOL GRINDING

EASYMOUNTS and WHEELS

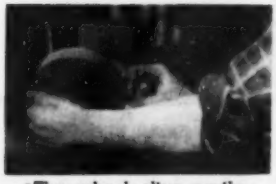
Conserve Steel. . . . One EASYMOUNT Replaces Hundreds . . . Thousands . . . of Conventional, Steel Wheel-Backs!

● Eliminate the necessity of ordering back-plates or returning old ones. Decide to use Sterling's Easymounts and Wheels from now on. Purchase the Easymount once and wheels in needed quantities. There is no waiting . . . more economy! Sterling's Easymount, made of lasting steel, securely fastens to your grinder and remains there for the life of the machine. You replace wheels only—a patented feature that means less down-time, and better grinding always!

No cements or glues hold the wheel to the back—instead, a special mechanical, retaining feature securely grips the wheel firmly in the Easymount until wheel replacement is necessary. Then, it is easily removed. Quick machine starts or reversals do not affect the Easymount's tight hold on the wheel . . . the wheel is locked in; it's there until released!

Test on your own machines the many exclusive Easymount features that provide faster, better production at lower cost. Easymounts and Wheels come in sizes and specifications suitable for fast, accurate grinding of all the carbides. Write for full information.

THE WHEEL IS SO EASY TO INSTALL OR REMOVE!



• The wheel slips easily into the Easymount, mounted on your grinder.

• Each screw furnishes proper tension as it is tightened, yet does not touch the abrasive at any point.

• After this quick assembly, the Easymount and Wheel are ready for long, efficient service.

SEND FOR THIS FREE ILLUSTRATED EASYMOUNT FOLDER!

For full description of Easymount Wheel specifications and Sterling's famous 23 Bond, send for this attractive folder. Prices and complete data regarding the proper sized Easymounts to use with various machines are contained in this literature which will be mailed at no obligation.

EL DIVISION TIFFIN, OHIO

QUARRIES COMPANY

Close Tolerances Held

V & O Presses at Sylvania Electric Products, Inc., are used to fabricate small, light parts for radio tube manufacture and heavier parts in television picture tubes, radio and television sets and various other components. Runs on some of these parts are as high as 10,000,000 pieces. Extremely close tolerances are being held for certain parts over these large quantities. "Without a press that could be relied upon," reports Sylvania, "such figures as those noted could not be continued day by day, and year by year."

OTHER EMHART PRODUCTS INCLUDE:

HIGH SPEED AUTOMATIC PRESSES
HENRY & WRIGHT
Division of Emhart Mfg. Co.
HARTFORD 5, CONNECTICUT

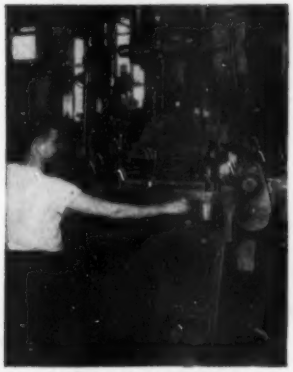
GLASS MAKING MACHINES
HARTFORD-EMPIRE CO.
Division of Emhart Mfg. Co.
HARTFORD 2, CONNECTICUT

AUTOMATIC PACKAGING EQUIPMENT
STANDARD-KNAPP
Division of Emhart Mfg. Co.
PORTLAND, CONNECTICUT

PLASTIC BOTTLES, RODS, TUBES, SPECIAL SHAPES
PLAX CORPORATION
Subsidiary of Emhart Mfg. Co.
HARTFORD 1, CONNECTICUT

on runs of millions of pieces

One Hundred V & O Presses are operated by Royal Typewriter Co. for continuous production of numerous parts, such as top covers, key levers and base frames for portable typewriters. Operations performed on V & O Presses range from blanking to precision forming.



Assembly of Coils on the Room Air Conditioner production line at York Corporation is accomplished automatically on specially designed V & O Presses. This machine first feeds a roll of copper through rolls which corrugate fins, then to a die which punches, flares, curls and cuts off individual fins. Machine then stacks fins on copper tubes.

Production Increases in secondary die operations of 50%-100% are obtained with the V & O Feed-O-Matic.® This unique punch press feeder not only speeds output — it increases die life and minimizes operator fatigue. Operator's hands are never under punch. Feed-O-Matic delivers piece to die and automatically trips press. Can be used with any make of press.

Only the best is good enough

SEE OUR EXHIBIT
A. S. T. E.
INDUSTRIAL EXPOSITION
CHICAGO · MARCH 17–21
BOOTH 1331

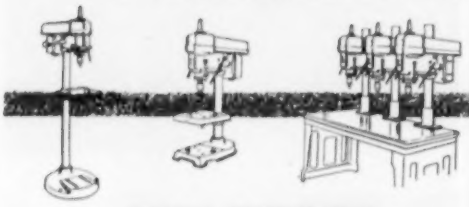
DESCRIPTIVE CATALOGS Catalogs containing complete specifications and operating details on V & O Precision Power Presses and Feeds are available. Please write The V & O Press Company, 301 Union Turnpike, Hudson, N. Y.

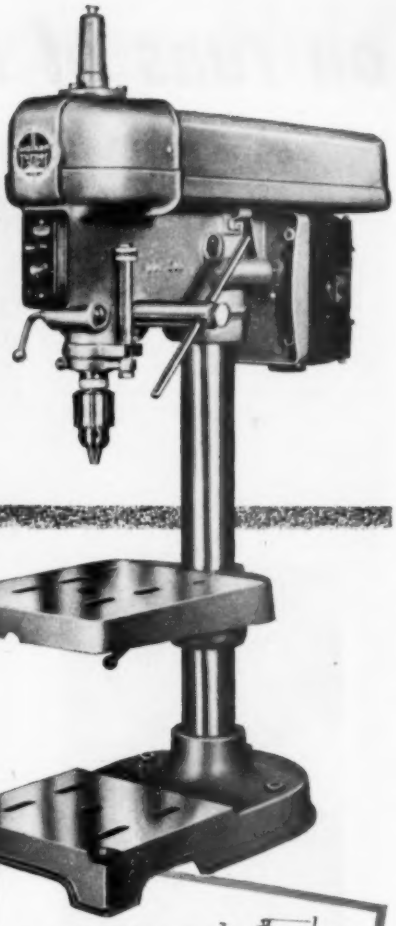
THE V & O PRESS COMPANY
Division of Emhart Mfg. Co.
BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889
HUDSON **NEW YORK**

What to look for at the A.S.T.E. Exposition

For fast, accurate drilling at new low levels of investment and production costs

NEW WALKER-TURNER
15" Production DRILL PRESSES





GENERAL SPECIFICATIONS

SPINDLE TRAVEL: 4¼" or 6".

FOUR SPEEDS: 600, 1250, 2440 and 5000 R.P.M. with 1740 R.P.M. motor.

CAPACITY: Bench Models—12" chuck to table, 17½" chuck to base. Floor Models—39¼" chuck to table, 46" chuck to base. All models 7¼" center of chuck to column.

CHUCK: #6A Jacobs key type capacity 0 to ½".

TABLE: 10" x 12¼" machined working area.

BASE: 10" x 9" machined working area on Bench Models. 11" x 9" on Floor Models.

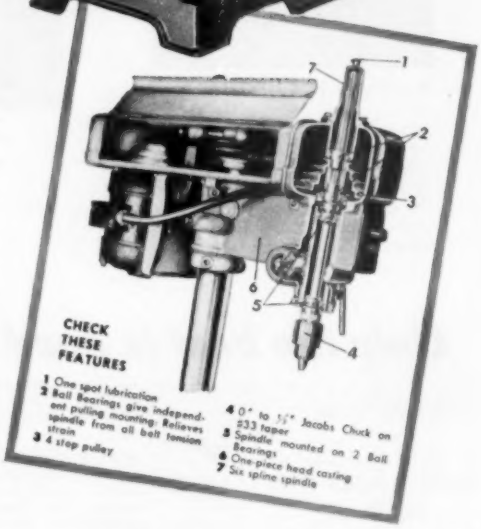
SPINDLE: Six spline full floating type, ⅝" diameter, male #33 Jacobs taper for No. 6A Jacobs Chuck, or #1 Morse taper socket (optional).

PULLEY: Straddle mounted on two ball bearings for extra rigidity. New upper mounting permits quick belt changing.

COLUMN: Ground seamless steel tubing, 2¼" in diameter.

The specifications give you some idea of the capacity, wide range of speeds, and up-to-the-minute engineering of the new Walker-Turner 15" Production Drills. When you see these machines in operation . . . note how readily they can be mounted in-line, for simultaneous drilling operations, you'll have a better idea of their accuracy and flexibility.

But it's only when these drill presses have been installed in your plant that you can appreciate how Walker-Turner design cuts drilling costs and increases productive efficiency. 72 different models, to meet practically every drilling requirement. Drill heads adaptable to hundreds of diversified uses.



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walker-turner DIVISION
KEARNEY AND TRECKER CORPORATION
PLAINFIELD, N. J.

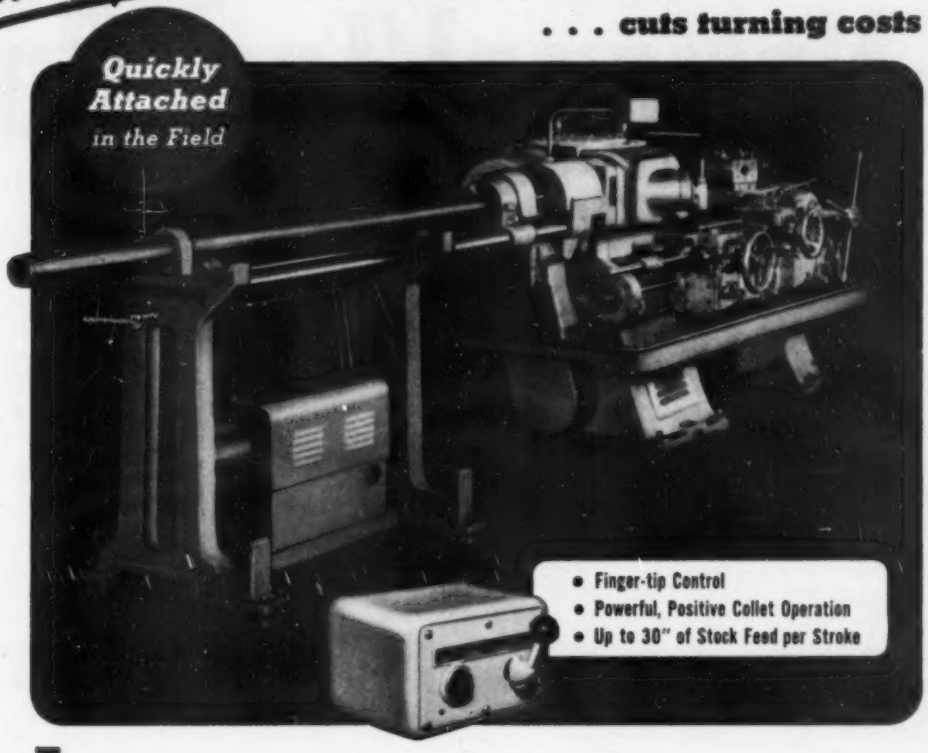
DRILL PRESSES • RADIAL DRILLS • TILTING ARBOR SAWS • BELT and DISC SURFACERS • METAL-CUTTING BAND SAWS • SPINDLE SHAPERS • JOINTERS

Power Operated

BAR FEED AND COLLET CHUCK

Increases production

. . . cuts turning costs



This new, work-saving development is a rigid, heavy-duty hydraulic unit built to handle full capacity bars at full capacity spindle speeds.

It provides effortless finger-tip control of bar feeding and chucking, enabling operators to *maintain a faster, steadier pace throughout the day.*

It can be attached quickly to ANY J & L No. 3, 4, 5, 7A and 8A Universal Turret Lathe in the field.

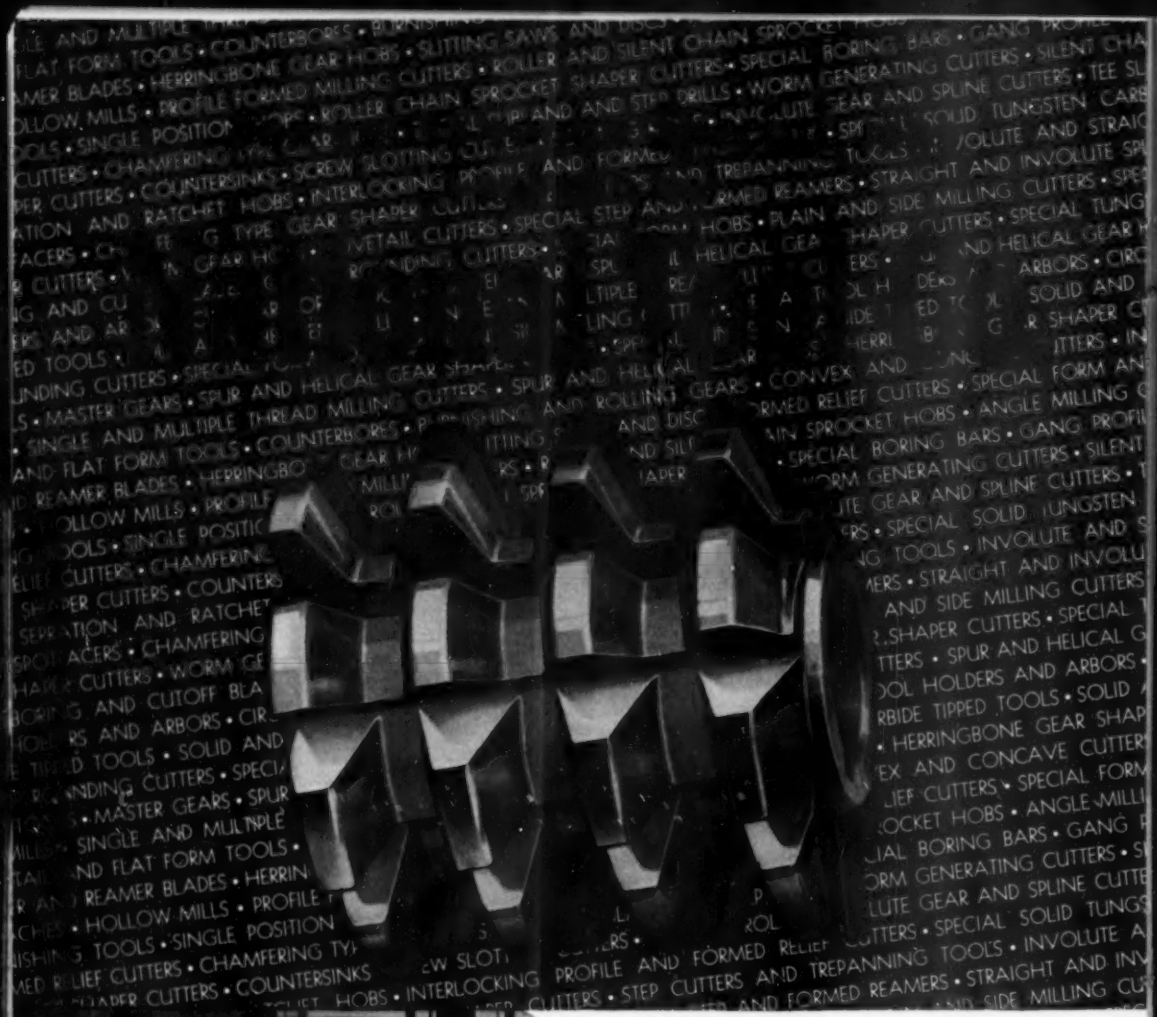
★ Handles ● ■ or ⬢ stock
★ Side-loading, silent safety tube
★ Heavy, wide support legs
★ Levelling and floor lagging screws
★ Wide-spaced steel guide bars
★ Feed chuck mounted on anti-friction bearings
★ Independent hydraulic unit
★ Automatic strip-back cycle
★ Auxiliary feed chuck available

Turret Lathe Division **JONES & LAMSON** J&L

MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Write to Dept. 710 for Complete Information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● **Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 45 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.**

National
TOOL CO.
Cleveland 2, Ohio

Since 1905 **engineers and manufacturers of high-quality special cutting tools for the metal-working industry**

ALLIS-CHALMERS
INDUCTION
HEATERS
Speed Production
Brazing housings for shock absorbers. Belt moves 2 feet per minute. Production: 6 pieces a min.

Jack-of-All-Trades

on hardening, annealing and brazing jobs

EVERY DAY, this eastern machine manufacturer is finding new jobs for his 20-kw Allis-Chalmers induction heater.

By merely changing the work coil, the single unit is used for case hardening, annealing, and brazing a wide variety of parts. Most pieces are in lots of 50 to 4,000 and are fed through the work coil, either manually or automatically.

BIG ADVANTAGES

On one typical job, a carburizing process for hardening has been replaced. Result: faster production — reduced costs. In addition, scrap that formerly ran to 10 to 25% is completely eliminated.

Another job, brazing of carbide tool tips, is now completed in 40 seconds. With acetylene heating it took three to ten minutes per tool.

CHECK INTO SAVINGS

It's easy to find out what Allis-Chalmers Induction Heaters can do for costs in your plant. Simply call your nearby Allis-Chalmers district office and outline your heating problems. In fact, there may be a ready answer for you in the files on a similar job already processed. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

ALLIS-CHALMERS
Milwaukee 1, Wisconsin

- ☐ Please send me Induction Heater booklet 6430A.
- ☐ Please send print of 16 mm color sound film "Induction Heating, Industry's Modern Tool."
- ☐ Please have engineer call.

Name

Title

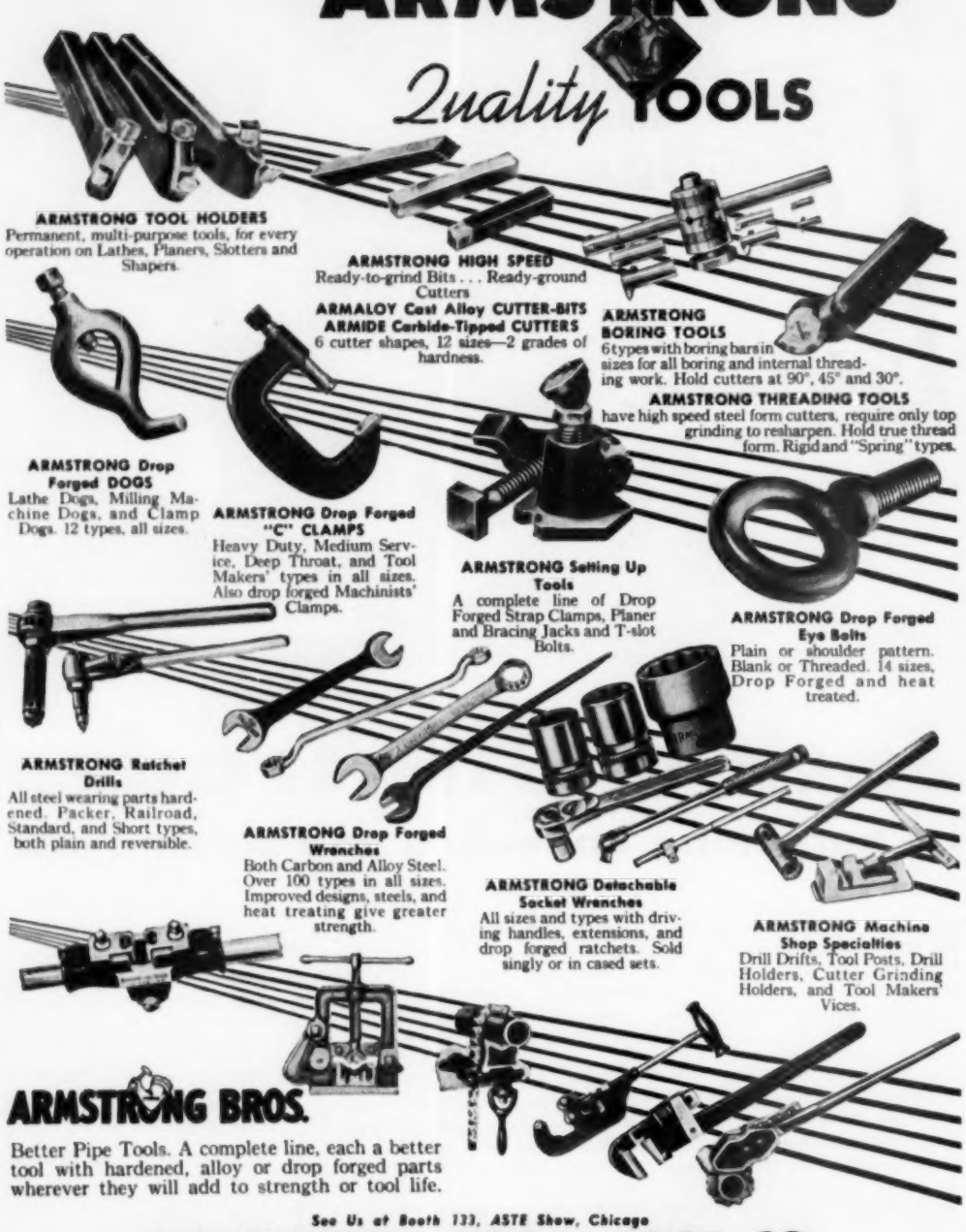
Company

Street

City State A-3610

ARMSTRONG

Quality TOOLS



ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED
Ready-to-grind Bits . . . Ready-ground Cutters
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades of hardness.

ARMSTRONG BORING TOOLS
6 types with boring bars in sizes for all boring and internal threading work. Hold cutters at 90°, 45° and 30°.

ARMSTRONG THREADING TOOLS
have high speed steel form cutters, require only top grinding to resharpen. Hold true thread form. Rigid and "Spring" types.

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Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also drop forged Machinists' Clamps.

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A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes. Drop Forged and heat treated.

ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating give greater strength.

ARMSTRONG Detachable Socket Wrenches
All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

ARMSTRONG Machine Shop Specialties
Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vices.

ARMSTRONG BROS.

Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

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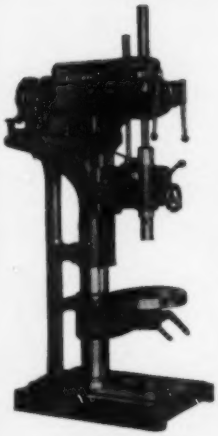
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

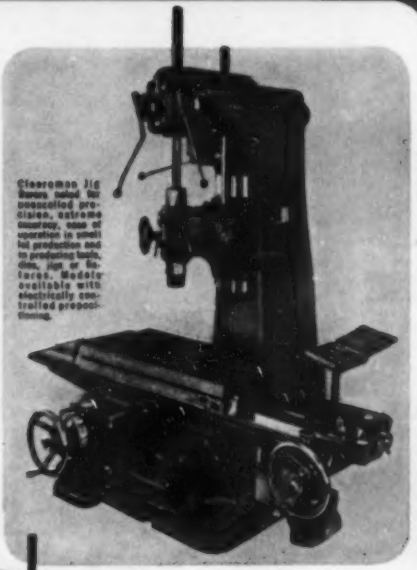
5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

THE CLEEREMAN LINE

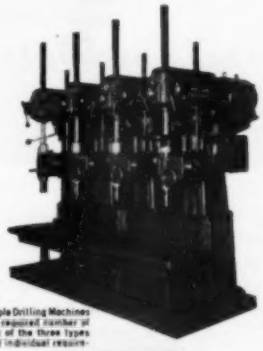


Cleereman Round Column Drilling Machines produce accurate holes at high speed and at low cost and are general purpose machines with high production.

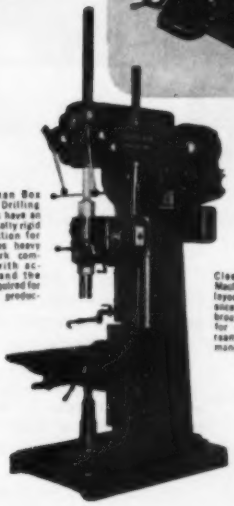
Cleereman Model 325 Single Unit Sliding Head Drilling Machines combine extreme sensitivity with rugged construction, are extremely versatile and may be used for production drilling and tapping.



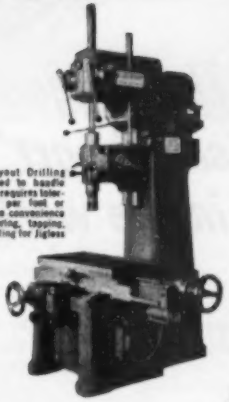
Cleereman Jig Borers noted for unexcelled precision, extreme accuracy, ease of operation in small lot production and in producing tools, dies, jigs or fixtures. Models available with electrically controlled preselective timing.



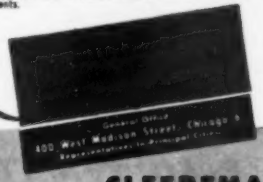
Cleereman Multiple Drilling Machines consisting of the required number of machines of any of the three types supplied to meet individual requirements.



Cleereman Box Column Drilling Machines have an exceptionally rigid construction for continuous heavy duty work combined with accuracy and the speed required for low cost production.



Cleereman Layout Drilling Machine designed to handle layout work that requires tolerances of .001" per foot or broader. Extreme convenience for drilling, boring, tapping, reaming and milling for jigless manufacturing.



Affiliated with..

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

The biggest "small part" in the world!

Many of the parts needed in factory production are mighty small. But these parts can loom up mighty *large*—when they're missing!

For tiny as they are, their absence can halt an entire production line—can cost a manufacturer thousands of dollars *every day* while he waits for replacements to arrive.

And the sources of supply are often hundreds of miles from his factory!

What does he do? He cuts replacement time from days to hours. He gets needed parts the world's fastest way—via Air Express!

The money saved by Air Express speed is figured in millions—but its cost is counted in pennies. Whether you need steel bolts or bolts of cloth, you can profit from regular use of Air Express. Here's why:

IT'S FASTEST—Air Express gets *top priority* of all commercial shipping services—gives the fastest, most complete door-to-door pick-up and delivery service in all cities and principal towns at *no extra cost.*

IT'S DEPENDABLE—Air Express provides one-carrier responsibility all the way, gets a *receipt upon delivery.*

IT'S PROFITABLE—Air Express service costs less than you think, gives you many profit-making opportunities.

New parcel post regulation affect you? Call your local agent of Railway Express, Air Express Division.

AIR EXPRESS

GETS THERE FIRST

BULLARD

MANUFACTURERS OF MACHINE TOOLS

Boulder Dam, Arizona from the Nevada Side — Kaufman & Fabry Photo

The Invisible Background of Industrial Progress

Boulder Dam or, as some people know it, "Hoover Dam" was authorized by Congress December 21, 1928, and completed in 1936. It is the world's highest dam, creating Lake Mead, the world's largest artificial lake. It provides for river regulation, flood control, irrigation and power.

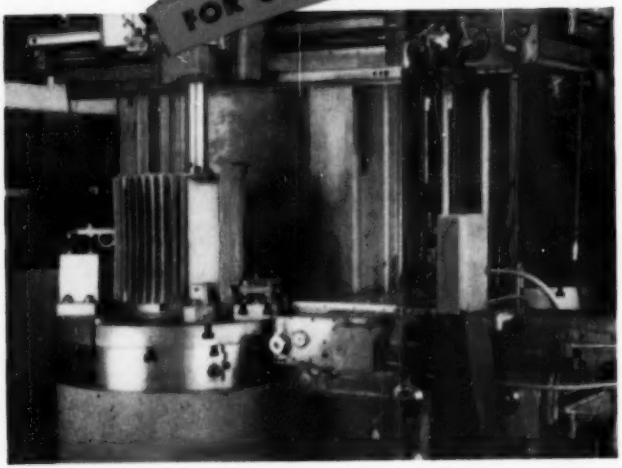
The capacity of its generating plant is rated at 1,034,800 kilowatts, supplying about half of the power required in Southern California. . . Free government, free enterprise and American ingenuity conceived and completed this gigantic project adding immeasurably to our general economy through benefits to the American people. . .

★ *Modern Machine Tools* played an important part in the manufacture of construction machinery and equipment used in building Boulder Dam as well as many of the component units in its operating and maintenance facilities. Yes, Machine Tools are an important factor in manufacturing parts for generating plants, other transmission equipment and the entire electrical industry. . . New industrial and agricultural developments in our great Southwest are directly attributed to such projects as Boulder Dam and indirectly to Machine Tools in the Invisible Background.

THE BULLARD COMPANY
BRIDGEPORT 2
CONNECTICUT

★ *For greater manufacturing economy*
REFER to next page

BULLARD MACHINE TOOLS
FOR GREATER MANUFACTURING ECONOMY



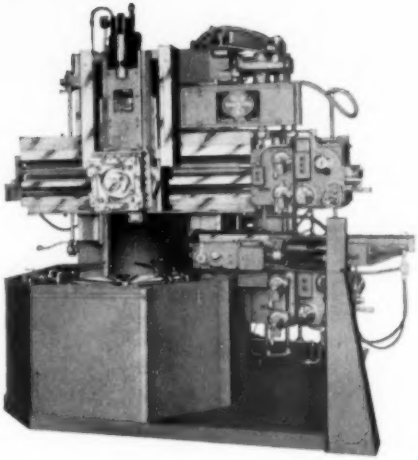
The inception of Bullard Man-Au-Trol Vertical Turret Lathes began a New Era of metal cutting in the field of single spindle turret lathes.

Man-Au-Trol principal provides both manual or automatic control of the machine and a simple method of predetermined operations easily reset for changes in work design.

Versatility and many modern features of Man-Au-Trol Vertical Turret Lathes place them at the top of the list for Greater Manufacturing Economy.

Machining an electric motor frame as illustrated above is only one of the many classes of work that Man-Au-Trol produces for the Greater Economic World in which we live.

The present urgency for delivery of electrical units needed to power all types of Industries, road building, agricultural, transportation and many, many other kinds of equipment are calling upon Bullard for delivery of Machine Tools to speed the manufacturing processes.



Learn more about Man-Au-Trol Vertical Turret Lathes built in 30-, 36-, 42-, 54-, 64-, and 74-inch sizes. Write for circular.

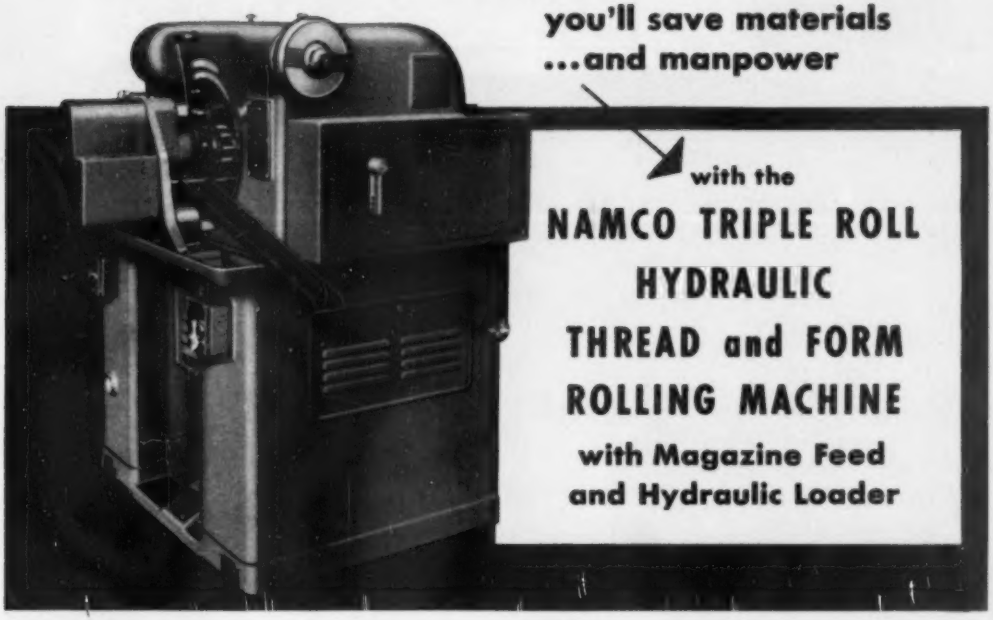
BULLARD

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

FOR SMOOTH THREADS...*FAST!*

you'll save materials ...and manpower



with the

NAMCO TRIPLE ROLL HYDRAULIC THREAD and FORM ROLLING MACHINE

with Magazine Feed and Hydraulic Loader

This precision high-production machine is the perfect answer for makers of instrument, aeroplane or automotive dry-seal parts for the defense program. Thread lengths greater than twice the diameter can be produced smoother, faster—and with a greater saving in materials and man-hours than by any other method.

The Namco Thread-Roller operates on either the plunge-cut or the feed-through principle, with interchangeable two-roll or three-roll heads and straightline support. Class 3 fit and unsurpassed finish (superior to ground-thread production) are characteristic.

Capacities range from $\frac{3}{8}$" up to $1\frac{1}{2}$" using three rolls—and $\frac{1}{8}$" to $\frac{3}{8}$" using two rolls. Because of its three-roll operation and three-point support, which eliminates distortion, the machine is a "natural" for hollow work.

To save additional man-hours and permit the use of unskilled labor, magazine feed and hydraulic loader are available. This combination makes the Namco Thread-Roller the fastest, most versatile, most accurate, *most economical* means of thread production available today. Send us samples of the jobs you want to do; we'll do the rest—in quoting you on your requirements.

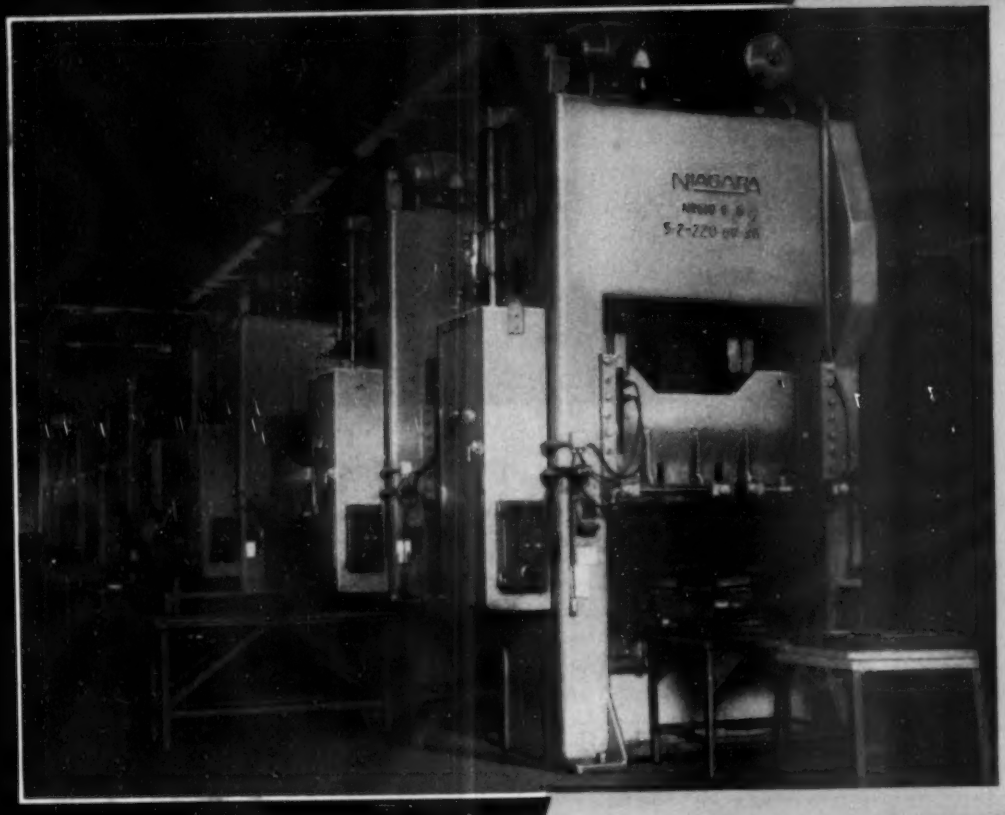
Ask us for your copy of this twelve page bulletin (TR 49) giving complete details on the Namco Thread-Roller.

The NATIONAL ACME CO.

170 EAST 131st STREET · CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

NIAGARA



Typical production line of Niagara Straight Side Double Crank Presses in one of America's foremost automotive plants

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

straight side double crank PRESSES

Speeding up Defense Production in Large Automotive Plants

Niagara advanced engineering features and modern streamline styling combine to make these presses leaders in their field.

- Electrically welded steel construction
- Air actuated electrically controlled sleeve and friction clutches
- Anti-friction bearing mounting for high speed shafts, flywheel and clutch wheels
- Gearing enclosed and running in oil
- Neither gearing nor shafting overhang the working area to block light and be a potential danger
- Single and double geared
- Single or double end (twin) drive
- Adjustable air counterbalance for slide
- Pneumatic draw cushions with adjustable pressure and surge tank
- Wide range of sizes and capacities
- J. I. C. features if desired

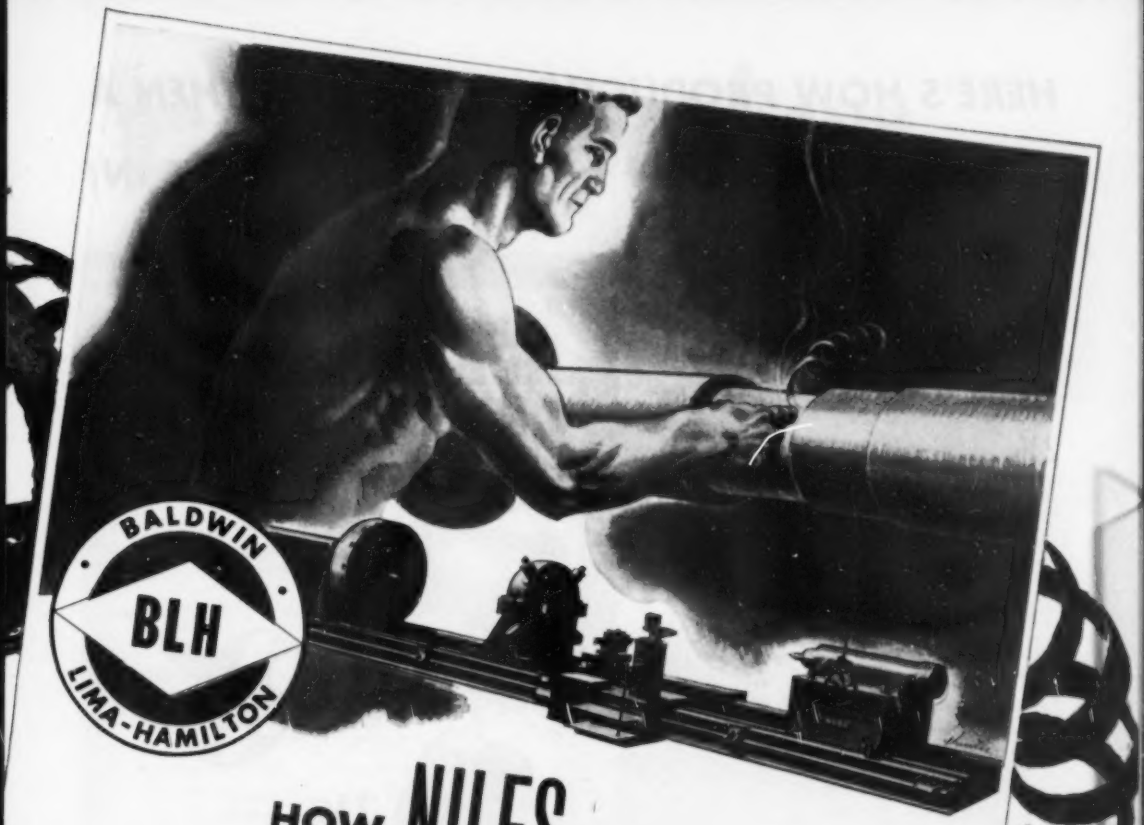
Write for catalog

Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK

... and each a "blue-chip" product

Boring Mills
Planers
Vertical Side-Head Boring & Turning Mills
Axle Burnishing Lathes
Hydraulic Centering Machines
Car Wheel Lathes
End-drive Axle Lathes
Diesel Wheel Borers
Plate Planers
Horizontal Mills
Engine Lathes



HOW NILES ENGINEERING

helps output take a turn for the better

Engineering machine-tool giants that can hog out ¾-inch chips . . . then finish cut to ten-thousandths . . . is our business here at Niles. And after a century of such specialization, we *know* how to engineer the big tools to give you big output.

How big a machine tool do you need? We've built many of the largest ever made . . . lathes with 10-foot swing . . . planers with a 15-foot clearance between housings . . . boring mills with 43-foot swing.

Do you need extra power? All Niles tools are designed with extra rigidity and more power . . . designed to shrug off the stresses of deep cuts and modern feeds and speeds with carbide tipped tools.

Do you need precision plus? We make Niles tools heavier and more powerful, but we also build them to the highest precision standards . . . build them to give you consistent, close, sustained accuracy. That's the reason they're top favorites with the close tolerance manufacturers of precision instruments, ball bearings, tools, dies, and other machine tools.

So why not check Niles when you tool-up. Niles is one of the *great* names in machine tools . . . and the payoff to you is in a *greater* output with *greater* accuracy, over a *greater* number of years.

Why not write *today* for Catalog 91551.

Write to

LIMA-HAMILTON DIVISION

Hamilton, Ohio

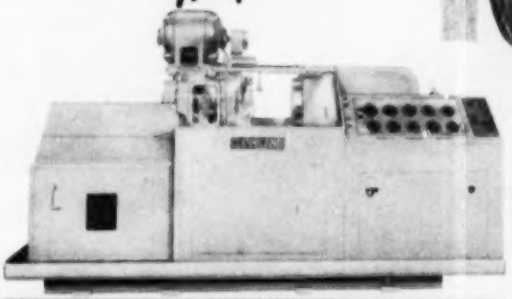
BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

HERE'S HOW PRODUCTION WENT UP...WHEN A NEW CLEVELAND *DIALMATIC* WENT IN!

Eclipse-Pioneer Division, Bendix Aviation Corporation, blanks these parts on a new 2½" Dialmatic Cleveland.

they report these increases in production



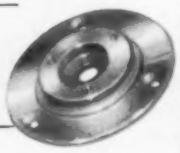
Model AB Dialmatic Cleveland 2½" Single Spindle Automatic (Also supplied in 3" capacity)

Barrier - Magnet Aluminum 1.47" diam. **48%**

17% Nut Blank E-8740 Steel 2⅛" diam.

Rotor Shaft Stainless Steel 1.46" diam. **33%**

71% Adapter Aluminum 1.92" diam.



End Cap Aluminum 1.95" diam. **157%**

30% Bellows Bottom Clamp, Brass 1.45" diam.

Clamp Ring Aluminum 1.81" diam. **35%**

And these are typical—not unusual—production increases. *Many* manufacturers have stepped up productivity by replacing prewar automatics and turret lathes with new Dialmatic Clevelands. How much will *your* production benefit? Let a Cleveland Engineer show you. Send us samples or part prints. There is no obligation, of course.

Remember . . . *Clevelands Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO · CLEVELAND · DETROIT HARTFORD · SO. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

56 Parts per hour...

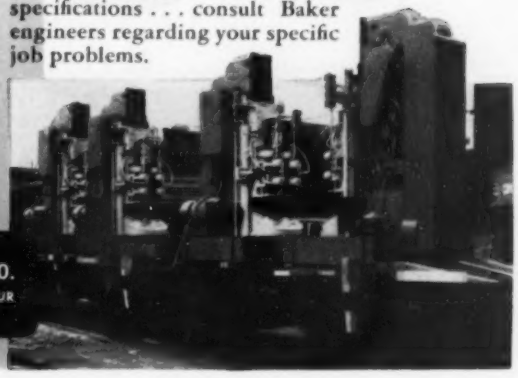
BAKER

KEEPS MORTAR SHELLS ROLLING OFF THE LINE!

Better machine tools are the bulwark of American defense. Today, from coast-to-coast, Baker special machines are hard at work increasing production figures in the manufacturing plants across the nation... New Baker special machines are rolling off the line for even greater productivity, as fast as they can be designed and manufactured.

Increased production is attained in boring and counterboring operations on 4.2 inch chemical mortar shells with Baker special machines. Rate of production . . . 56 parts-per-hour. The machine . . . Baker Model 30 HO Heavy Duty Two Spindle Inverted Type Hydraulic Feed High Speed Boring Machine. The operations... chucking two shells; locating shells over spindles from fixed vee blocks, one each at upper and lower end of each shell; bore 3.73" diameter hole to 15 inch depth of cut; counterbore 3.74" diameter hole to 7/16 inch depth of cut.

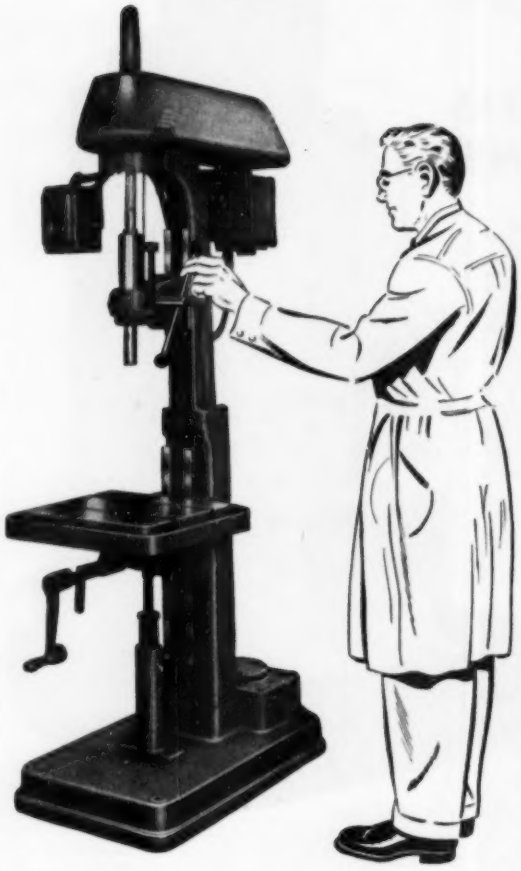
Baker special machinery is designed to meet your specifications . . . consult Baker engineers regarding your specific job problems.



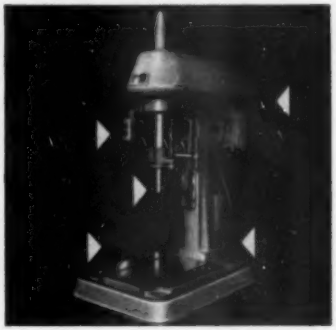
BAKER BROTHERS Inc., Toledo, O.

DRILLING, BORING, TAPPING, KEYSEATING AND CONTOUR GRINDING MACHINES

you can even **feel** them 'make time'



You can tell by the quiet smooth operation of these C-O Cincinnati 16"-3000 drills that they're really built for accurate work, long hours, and consistently high earnings. High production . . . freedom from vibration and chatter . . . plus **the "feel" of a fine tool** are the end result of the extra features that make these drills **"of outstanding value."** And remember, this is just one of many machines available in the complete C-O Cincinnati line to meet all your drilling requirements.



Accurate, alloy steel spindle, mounted in a ground steel quill between permanently sealed high-grade ball bearings. Capacities up to 1" in cast iron.

Full floating drive transfers all belt pull to two additional ball bearings in the spindle pulley.

Hand-scraped head ways cast integrally with the frame provide rigid support for the head. (Counterweight concealed in frame.)

Tilting motor bracket permits easy belt shifting for speed changes without wrenches, helps maintain proper belt tension.

Positive, speedy spindle return is adjustable to changing job requirements.

Write for Catalog D-108 and the name of your dealer.

CANEDY-OTTO DIVISION

CINCINNATI 9, OHIO, U.S.A. **cincinnati lathe & tool co.**

What's in Vermont this month?

NEW SLIDES ELIMINATE OIL FILM BEARING. Bryant has developed a preloaded ball bearing slide for their internal grinders that is unique in both construction and performance. It comprises sleeves with rows of ball bearings that provide rolling metal-to-metal contact. It forms an extremely sensitive, yet rigid, mounting.

Two of these bearings on one bar maintain axial alignment; a third bearing on another bar gives the slide a widely spaced, three-point support. The Bryant slide resists all lateral thrust since preload is radial. This design avoids the objectionable feature of conventional slides in which the oil film causes a slight flotation resulting in slight misalignment of the members.

One slide under the workhead and one under the wheelhead eliminate a compound slide and keep the workhead and wheel near the bed of the machine for maximum rigidity.

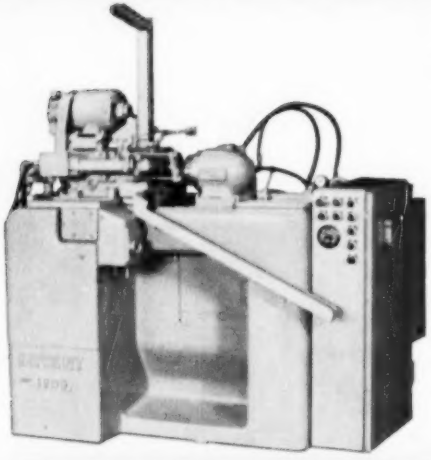
This design was planned for exclusive use on machines of the "high precision" class where a shift of 20 millionths of an inch due to oil film would result in work spoilage.

The design has proved so successful, where fast stock removal and extremely close tolerances are required, that this slide is now standard on the Bryant No. 1209 Automatic.

This is an example of how new basic design in modern machine tools can increase your precision production.

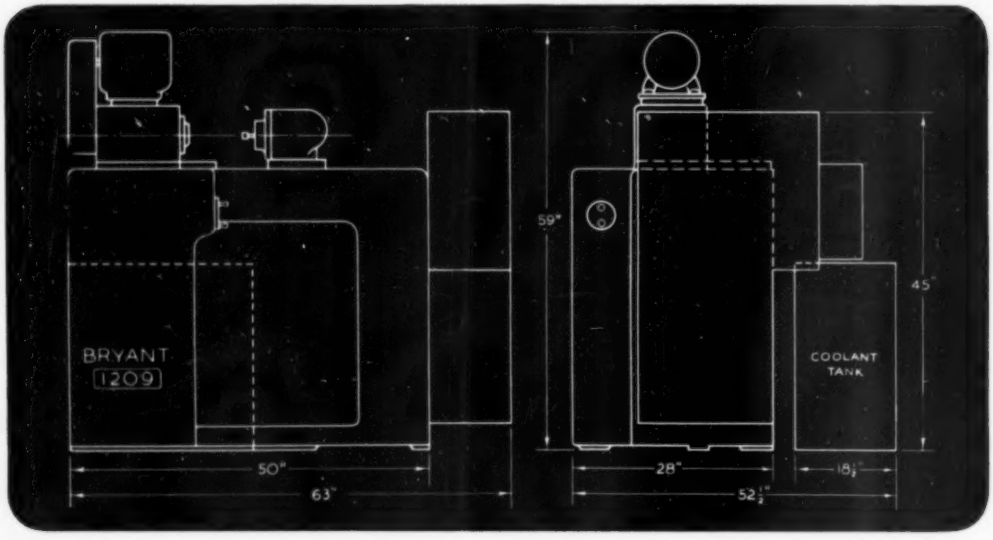
Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

FOR HOLE GRINDING

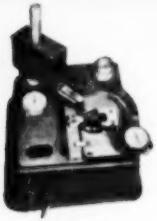


The Bryant 1209 Automatic Hole Grinder

This machine is designed particularly for high production, precision grinding of bores from ¼" to 3" in ball bearing races, gears, rolls, bushings, etc. Operator merely loads work, trips a valve to start cycle, and unloads the finished piece. The machine automatically *rough grinds, finish grinds and returns to chucking position when finish size is reached.* Hydraulic control, with individual throttles, gives infinitely variable control for each phase of the grinding cycle. The work spindle and cross feeds are driven by independent D. C. motors, giving infinite speeds and feeds with dial control. Wheel speeds up to 100,000 R.P.M. are obtained with the Bryant Hi-Frequency Wheelhead. Write for folder.



FOR CHECKING SQUARENESS OF UNDER-FACE



Bryant Thread Gage with Squareness-of-under-face Attachment

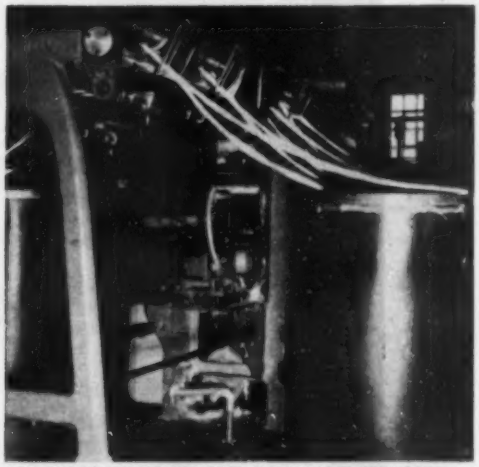
When an under-face must be checked square with an external thread, the part should be held on the thread flank and rotated in this position. The Bryant Gage does this, regardless of variation in roundness, P.D., lead or thread form. The attachment can be adjusted to check the under-face of any part which can be held in the gage. Illustrated is the No. 2 gage with a range from 1" P.D. to 2⅛" P.D. Simultaneous readings can be made — the attachment shows face run-out — the Bryant Thread Gage checks thread size — *giving accumulated reading of P.D., form and lead on dial indicator 4 to 5 times faster than plug gaging.* Send for folder.

Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

THEY USE G-E GEAR-MOTORS FOR DEPENDABLE LOW-SPEED DRIVE

"G-E GEAR-MOTORS ABSORB SHOCK LOADS ON MIXERS . . . USED FOR 20 YEARS . . . GOOD SERVICE"
These stationary bowl mixers of Baker Perkins manufacture are used at the Lee Baking Company, Atlanta, Georgia. "Much power and low speed are required on these mixers where dough, bouncing around inside, increases the load on the gear-motor suddenly and violently . . . compact, efficient, the gear-motor design fits in very well, and we have used G-E gear-motors for twenty years with very satisfactory service," says Mr. H. K. Smith, engineer at Baker Perkins. Mixers shown here use 30/15 and 40/20 hp, two speed G-E gear-motors, which are built into the mixers.

". . . DEPENDABLE . . . HAVE USED G-E MOTORS ALMOST EXCLUSIVELY FOR 40 YEARS . . ."
Kinney pumps are usually used on jobs requiring 24-hours a day, 6 or 7 days a week operation. Mr. R. C. Webster, General Sales Manager of Kinney states, ". . . gear-motors used must be dependable above all else. We have used G-E motors almost exclusively for 40 years all over the world. In our export business we find the customer specifically specifies G-E motors." Here a G-E gear-motor specialist discusses the application of G-E gear-motors on Kinney vacuum pumps with H. B. Neal, president, and H. R. Acres, G-E sales engineer.



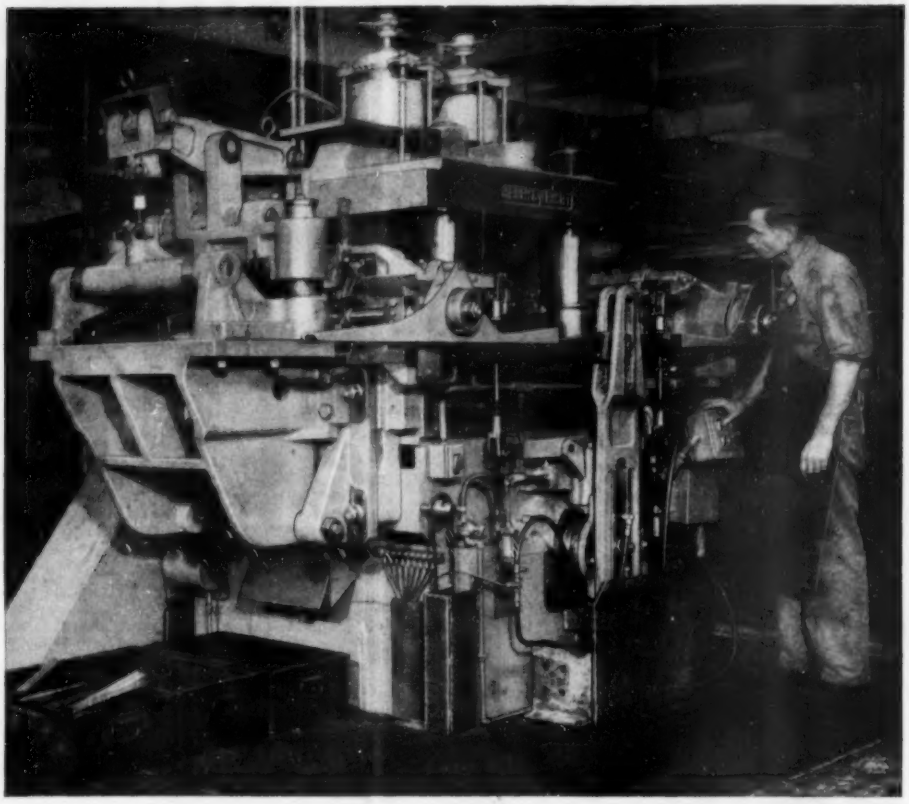
"GIVE GOOD SERVICE; COMPACT, BUILT-IN LOW-SPEED DRIVES.."
G-E gear-motors give good service at an Eastern textile mill—working in an atmosphere kept at 60 per cent humidity and constantly filled with cotton fibers. Here a G-E gear-motor with a ratio of 6.25 to 1 drives the lap winder. Winders, taking the cotton after it has come from the "cards," and forming laps for use on "controlled draft drawing," must operate at a smooth, constant, low speed. Engineers also state the gear-motor provides a more constant rpm than they can obtain in any other way.

Here are only three of the hundreds of applications for which reliable G-E gear-motors provide steady, low speed from a single compact unit. Where continuous processing, low steady speed, and severe duty cycles are encountered, G-E gear-motors have an outstanding record for long, dependable service. G-E gear-motors are standardized to minimize stocking of spare parts. They save much needed space because they are compact. They reduce hazards—often a drawback with line shafts and separate, unprotected gears. G-E gear-motors are available in 1 to 200 horsepower. For more information, write for bulletin GEA-1437 to Section 755-7, General Electric Company, Schenectady 5, N.Y.

GENERAL ELECTRIC

755-7

H & W Dieing Machines



New, Bigger Dieing Machine is producing 4500 pieces per hour for Hart & Cooley Mfg. Co. This new 200-ton machine features basic Henry & Wright design principles:

- Flywheel, crankshaft and connection are below the punchholder instead of above.
- Low center of gravity for high speed with minimum vibration.
- Punch is pulled, not pushed.
- Maximum guiding surface — four post guide for punchholder.
- Upper crosshead takes only the pressure necessary to perform work in die — no crankshaft thrust.

OTHER EMHART PRODUCTS INCLUDE:

PREMIUM QUALITY STAMPING PRESSES

THE V & O PRESS CO.

Division of Emhart Mfg. Co.

HUDSON, NEW YORK

GLASS MAKING MACHINES

HARTFORD-EMPIRE CO.

Division of Emhart Mfg. Co.

HARTFORD 2, CONNECTICUT

AUTOMATIC PACKAGING EQUIPMENT

STANDARD-KNAPP

Division of Emhart Mfg. Co.

PORTLAND, CONNECTICUT

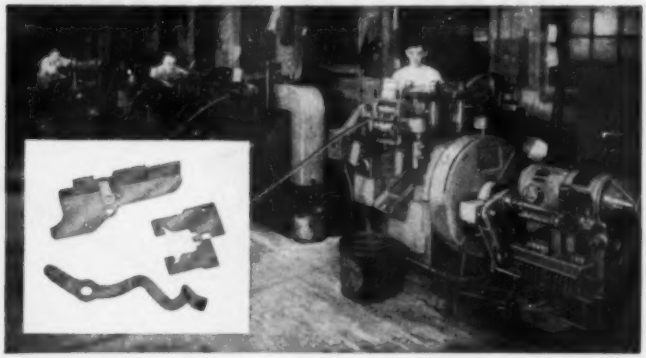
PLASTIC BOTTLES, RODS, TUBES, SPECIAL SHAPES

PLAX CORPORATION

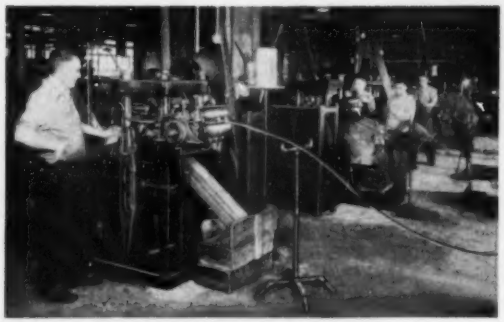
Subsidiary of Emhart Mfg. Co.

HARTFORD 1, CONNECTICUT

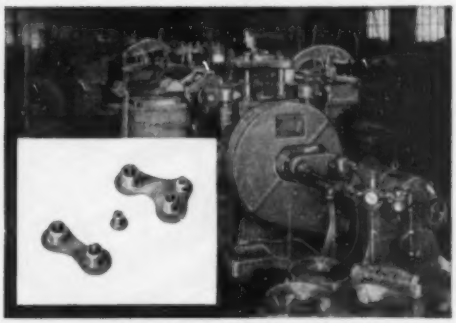
many more pieces at much less cost



Runs of 3,000 to 100,000 are produced on Henry & Wright Dieing Machines at Underwood. About 200 different typewriter parts are made on them, ranging from simple piercing and blanking to stampings produced in multiple station dies including piercing, lancing, extruding, shaving, forming and blanking with each stroke of the machine.



Thousands of Different Parts are produced on Henry & Wright Dieing Machines at the P. & F. Corbin Division of American Hardware Corporation. Variable speed drive on the H & W machines permits Corbin to select stroke rate best suited to the various types of parts.



Waterbury Brass Goods Branch, American Brass Company, Waterbury, Conn., has a group of Henry & Wright Dieing Machines for formed metal parts where the quantities involved average one million pieces or more per item. Economical production costs are consistently obtained. Small parts are manufactured five at a time passing through as many as 14 die stations.

Only the best is good enough

FACT PACKED CATALOG

Complete descriptions of all Henry & Wright Dieing Machines. Write: Henry & Wright, 481 Windsor St., Hartford 5, Conn.

H&W

HENRY & WRIGHT
Division of Emhart Mfg. Co.

modern milling for

cutters
modern milling machines

multiple diameter milling with carbide

With properly designed carbide cutters you can make two, three and more cuts with one pass of the tool, remove four to twelve times as much metal compared to high speed steel cutters. To realize the full benefits of this high productivity, your milling machine must be in tip-top condition and take the accelerated speeds and feeds without vibration or backlash. The workpiece must be rigid and anchored close to the table.

On the left is a group of typical OK tools for multiple cutting with either high speed steel or carbide blades. OK cutters are sound in basic design. The simple, two-piece construction—body and blades—is the ultimate in strength, power and efficiency. Blades, once set, are immovable, and yet come out with a drift in a jiffy. They are easy to regrind and replace.

OK is backed by an experience of 50 years . . . engineering thousands of carbide milling and boring tools.

On request we would be glad to send you the Latest Edition of Catalog 13, entitled: "Modern Milling Cutters for Modern Milling Machines."

The OK Tool Company, inc.
MILFORD NEW HAMPSHIRE

LESS THAN 1% REJECTS

by BROACH-RIFLING Gun Barrels!

Less than 1% rejects? Yes . . . considerably less, for in a lot of 17,000 barrels, 20 mm., 72" long, there were *only 5 rejects* when the rifling was done on LAPOINTE BROACHING MACHINES. Everyone can remember that just prior to World War II, when rifling was done on conventional rifling machines, the rate of necessary re-work often ran as high as 80% to 90%!

Now, in addition to the remarkable improvement in quality, there also is a significant production speed-up . . . with LAPOINTE BROACH-RIFLING. Here are some examples:

- In one plant, formerly one man ran two spindles and produced two barrels in 55 minutes. By Lapointe Broach-Rifling, the same man produced **50 per hour.** These were *finished barrels* — no reaming required, as before.
- A 20 mm. barrel was broach-rifled in **three minutes.** Former time, 4½ hours!
- A 37 mm. barrel was broach-rifled in **five minutes.** Former time, 6 hours!

LAPOINTE

Broach-rifling machines are fully described in our Bulletin HP-2.

50 YEARS IN BROACHING! We're the oldest in the world!
1902 • GOLDEN ANNIVERSARY • 1952

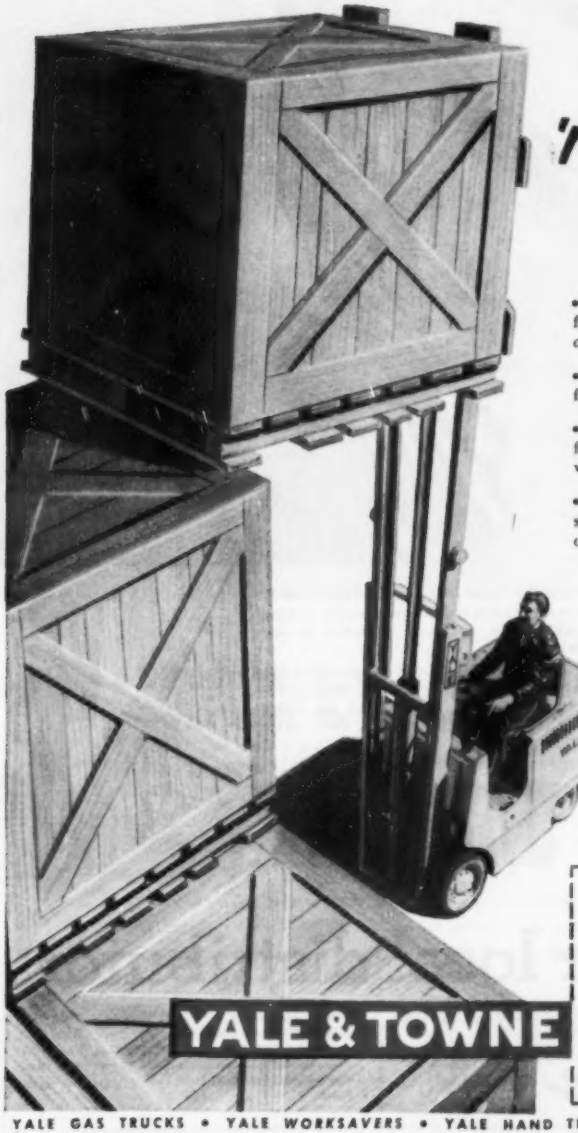
BROACHING is now the accepted method of rifling. If you contemplate handling such work, it will be to your advantage to consult LAPOINTE engineers. We have had the most experience in building broaching machines, broaching tools, and fixtures.

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
Branch Factory: Watford, Herts., England

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

More of industry's tough jobs go to YALE because...

EXCLUSIVE FEATURES EQUIP YALE ELECTRIC TRUCKS FOR



'round-the-clock service

- **EXCLUSIVE YALE** Hypoid Gears have more tooth surface for longer wear, greater shock resistance. They're completely enclosed in one oil-sealed unit.
- **EXCLUSIVE YALE** Involute Spline Drive Shaft resists fracture from wear fatigue—outlasts all others.
- **EXCLUSIVE YALE** Lift Channels are specially rolled for extra strength. Ball bearing rollers reduce channel wear, cut battery drain due to friction.
- **EXCLUSIVE YALE** Inclined King Pins absorb road shock on steering shaft, make driving easier. Reduce operator fatigue.

BECAUSE YALE Electric Trucks pay their way *better* by working longer—they're the first choice of users who want the *most* for their truck dollars. To discover how a YALE Electric Truck investment can accumulate *extra* handling savings for you—fill out and mail this coupon today.

YALE is a registered trade mark of the Yale & Towne Mfg. Co.

The Yale & Towne Manufacturing Co., Philadelphia 15, Pa.

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In Canada write The Yale & Towne Mfg. Co., St. Catharines, Ont.

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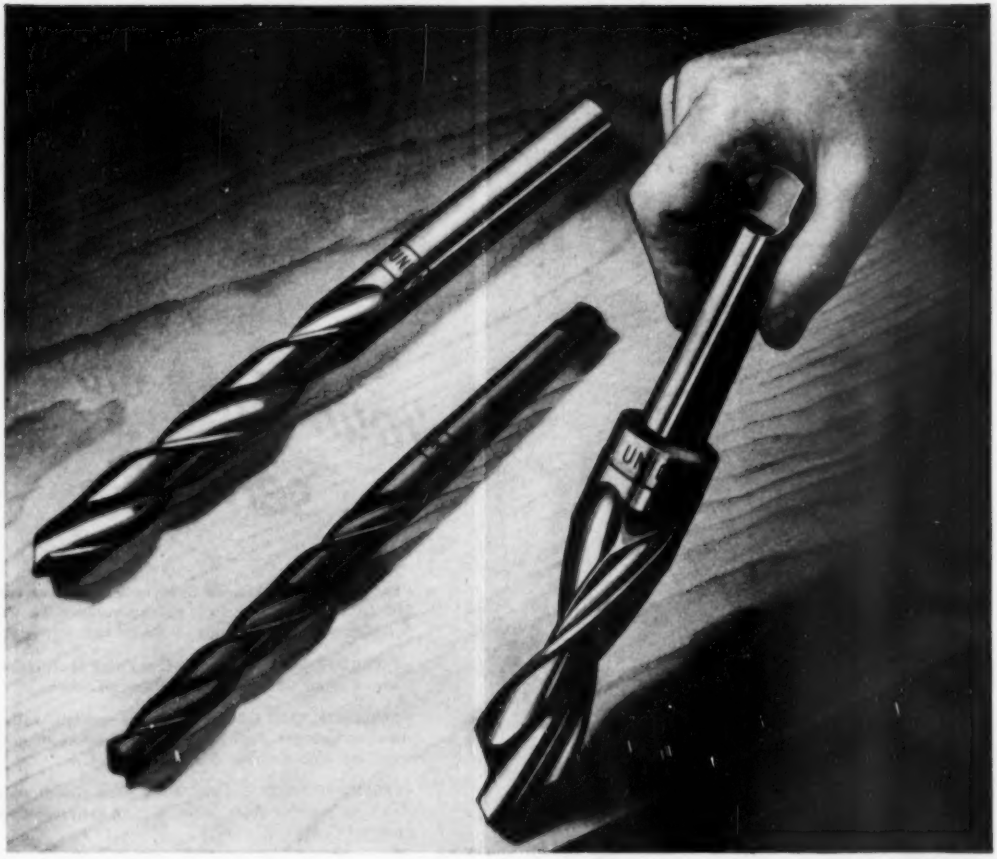


WHICHEVER TYPE YOU CHOOSE, you're sure of accurate, fast-cutting, long-lasting performance when you choose Union Twist Drills.

Union Straight Shank Drills come in carbon steel (No. 110) and high speed steel (No. 510) in 89 diameters from ¼" to 2". *Union Heavy Duty Taper Shank Drills* come in high speed steel (No. 370) in 81 diameters from ¼" to 1½".

Union Sub-Land Drills are specials made of high speed steel and are designed for drilling holes of two or more diameters in one operation.

The margin of each step is continued the full length of the flute so that these drills, by repeated sharpening, can be used the entire length of the fluted section.

no other twist drill will outperform a

contact your local distributor

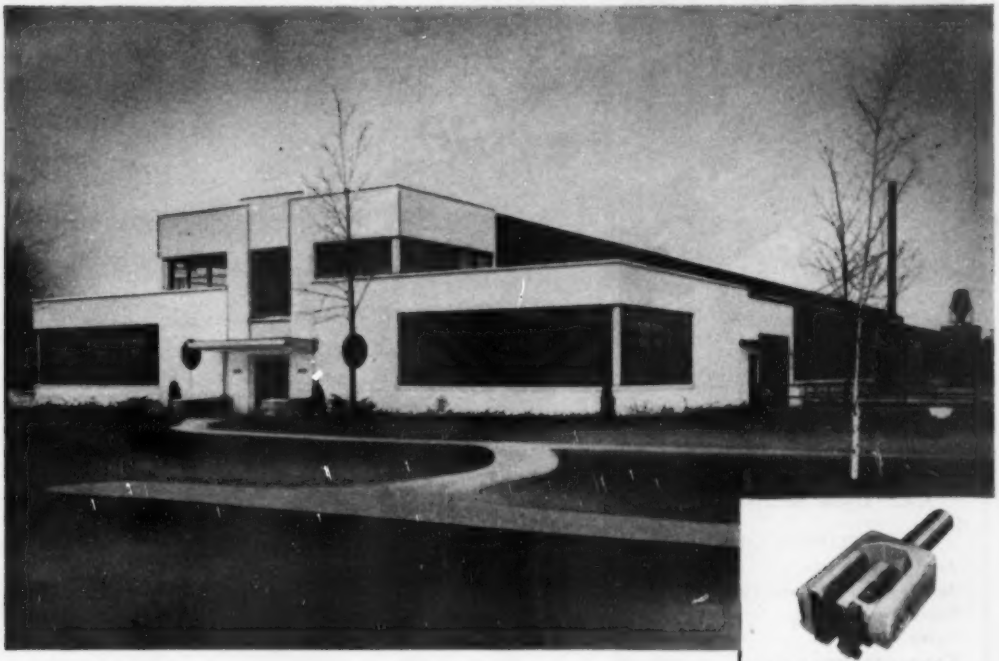
UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters Gear Cutters Twist Drills Hobs

Reamers Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

Davis Boring Tool increases facilities to give you even better deliveries



New 8-position tool holders

Block-type line boring tools. Planer and vertical boring mill tools.

Davis Super Micrometer Stub Boring Tool Sets.

New 30,000 sq. ft. plant will be producing Davis tools for you by mid-year

Here's one manufacturer who's doing something in 1952 to help you out with deliveries on standard and special boring, turning and planing tools.

Giddings and Lewis Machine Tool Co., recently purchased a new plant for its Davis Boring Tool Division that will increase production of Davis Boring Tools by 50%.

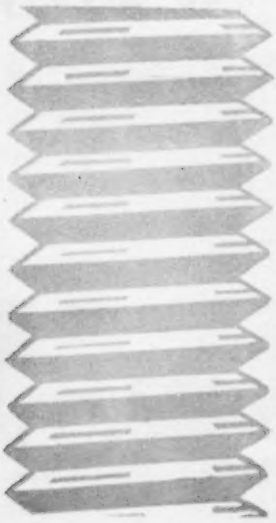
Now's the time — when deliveries look better — to standardize your shop on "Davis Complete Tooling Service." You can increase your production with present equipment, lower your costs and be sure of sharing in the very latest development in tool design. Write for complete details.

DAVIS BORING TOOL DIVISION
GIDDINGS AND LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN

See the complete Davis Tool Line

ABTE
SHOW
BOOTH 1705
CHICAGO, MARCH 17-21

still using "OLD FASHIONED" THREADING METHODS?



FACTS ABOUT THE CRI-DAN MODEL "D"

SPECIFICATIONS

Motor requirements	15 HP
Spindle speed (24 speeds)	100-1200 RPM
Swing over saddle	12"
Swing over bed	21"
Capacity between centers	60"
Maximum length of thread	5¼"
Max. exter. diam. of thread	12"
Max. inter. diam. of thread	16"
Maximum depth of thread	.250
Multi-start threads	Up to 12 starts
Taper threads	30° incl. angle
Length of machine	12'0"
Width of machine	3'7"
Height of machine	4'6"
Approx. weight of standard machine	6900 lbs.

Learn about the New CRI-DAN "D" —the largest of the CRI-DANS

50 CUTS A MINUTE . . . that's the speed at which the new Cri-Dan Model "D" Threading Machine can operate.

This unusual high rate of speed is accomplished with a SINGLE POINT CARBIDE THREADING TOOL which is controlled by a high precision cam instead of the conventional leadscrew. This cam guarantees accuracy of pitch as well as a precision thread.

The Cri-Dan Model "D" is the newly introduced "big brother" to the Cri-Dan "B" which has been setting new records in threading economy and accuracy.

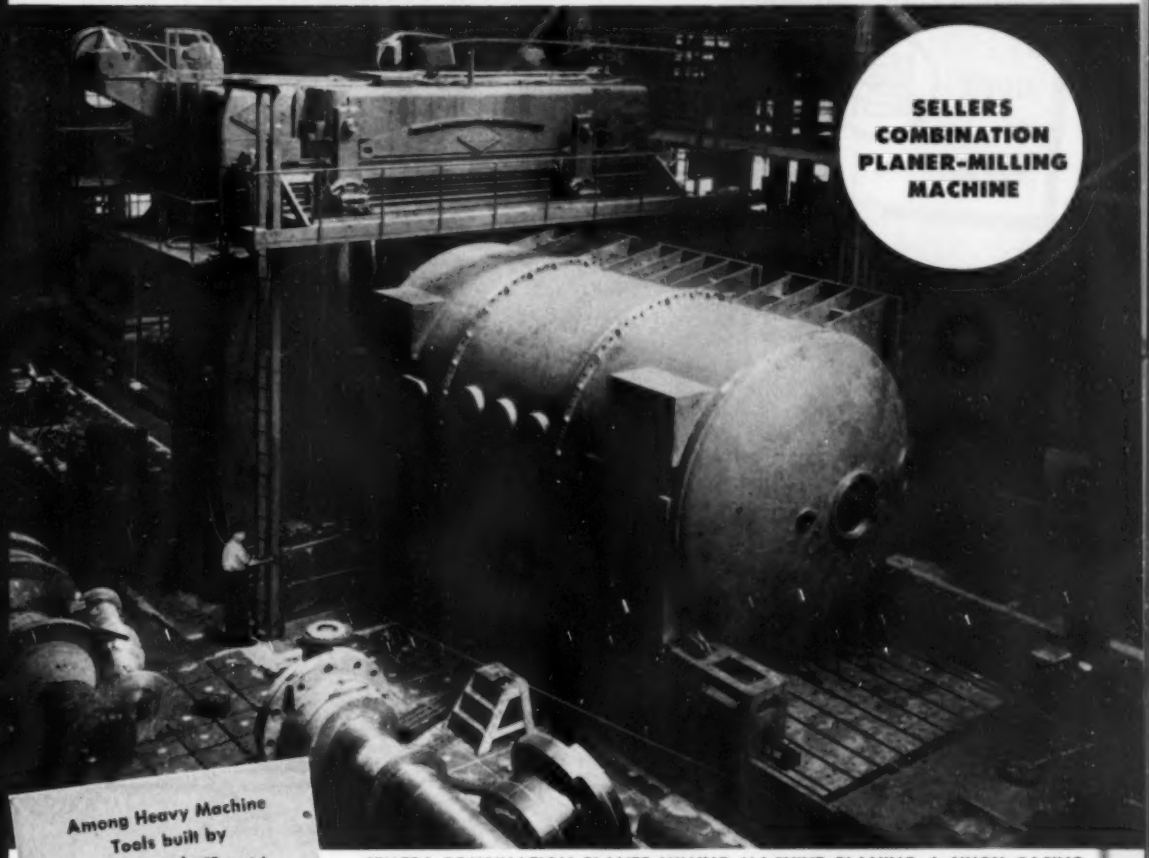
It will pay you to get the whole story on this time-saving, money-saving machine. Why not get in touch with your Lees-Bradner representative?

VISIT BOOTH 2030 AT THE A. S. T. E. SHOW AND SEE BOTH THE CRI-DAN MACHINES IN OPERATION

The LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

ANOTHER GIANT CONSOLIDATED SPECIAL MACHINE FOR UNUSUALLY LARGE WORK



SELLERS COMBINATION PLANER-MILLING MACHINE PLANING A HUGH CASING

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

The Sellers Combination Planer-Milling Machine is used in the production of equipment for industrial and power generating applications such as, synchronous condensors, hydraulic turbine-driven generators and large motors and generators for steel mills and similar installations. Two machines in one . . . a planer and a miller . . . it eliminates the necessity of transfering work from one machine to another when both planing and milling operations are required. This huge machine is over 76 feet long, 27 feet high and weighs more than 645,000 pounds. It has the capacity to machine work 14 feet wide, 16 feet high and 30 feet long. Due to the enormous capacity of the machine, several parts to be machined may be bolted together and handled as a single unit.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

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CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

SPEEDS UP PRODUCTION AS MUCH AS 300%

HIGH-SPEED HYDRAULIC COPYING LATHES

For Reduced Costs and Increased Accuracy
. . . Whether Quantities are Large or Small!

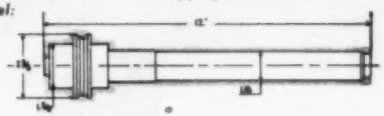
SETTING TIME ONLY 10 TO 20 MINUTES

GT MODEL Mold and sample of glass dish. Machining time: 3½ hours.

Typical part machined on the H.E.B. Copying Lathe — OP Model:

PISTON

SAE 1035 Steel copy-turned with carbide tool at 650 SFPM and .0135" Feed



Floor-to-Floor time: 1.85 minutes.

By installing the H.E.B. Copying Lathe with patented, built-in tracer device, you can increase production of all kinds of turned parts sometimes two and three-fold *with far greater accuracy and better finish* than on multi-tool lathes. Rejects are virtually eliminated . . Tooling is simplified . . Down-time is reduced to a handful of minutes, and short runs are highly economical because of low setting time!

The H.E.B. (OP Models) copy-turn *automatically* all types of shafts and other circular components. Multiple diameters, tapers, chamfers, radii, right-angled shoulders, etc., may be machined internally or externally within ±.0004" at spindle speeds of 50-3600 RPM, utilizing carbide tools at maximum capacity. 20 HP is available for heavy cuts.

Also available are the GT Models with rotating pattern, designed for copying an infinite variety of irregular, non-circular work. Molds for decorated glass bottles and bowls complete with lettering and designs, and also dies, cams, etc., can be machined more accurately with tremendous saving in time. Tracer pressure is so light that the pattern may be of wood or even plaster.

Investigate the ultra-modern H.E.B. copying method. Over a thousand of these fine lathes are now in use throughout the world . . . Designed and built in France by H. Ernault Batignolles, machine tool manufacturers for almost a hundred years!

Write us now for complete catalog or demonstration . . Immediate delivery—No priority required!

H·E·B

"THE WAY TO TURN"

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COPYING LATHES • ENGINE LATHES WITH COPYING ATTACHMENTS • TOOL ROOM LATHES • CARBIDE TOOL GRINDERS

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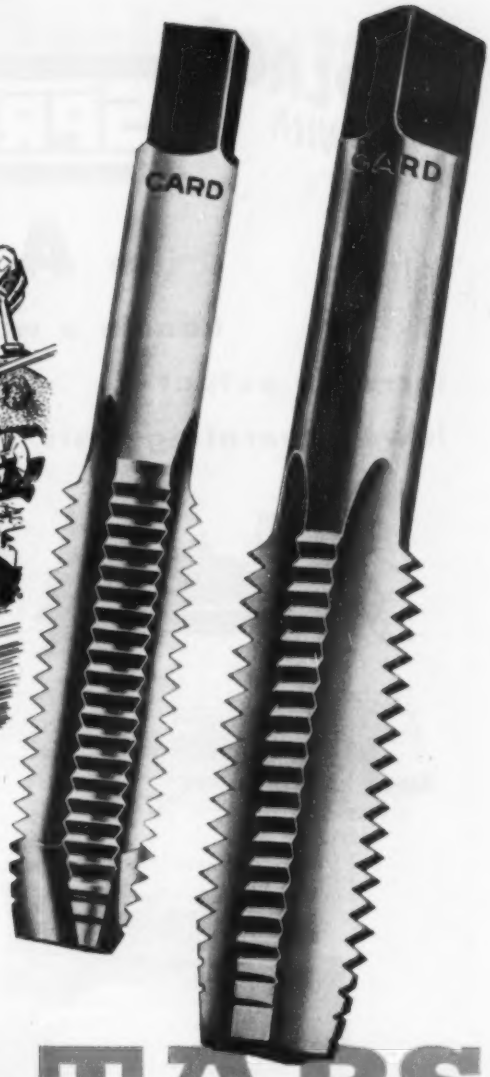

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All Card taps are given many rigid factory-inspections. They are manufactured in carbon steel and in high-speed steel – cut thread, commercial ground or precision ground. S. W. Card Manufacturing Company, Mansfield, Mass. Division of Union Twist Drill Co.

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The CARD Quality

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Also makers of DIES • SCREW PLATES • DIE STOCKS
TAP WRENCHES

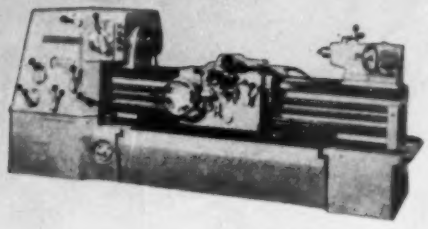
REPLACE With SPRINGFIELD

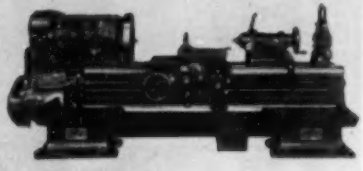
LATHES

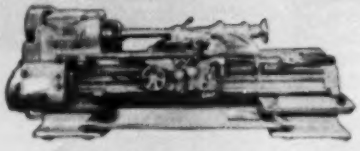
handle a wider range of work—

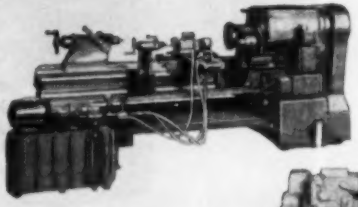
increase output—

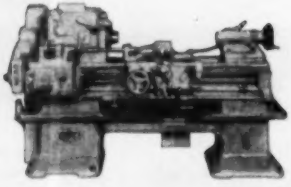
lower operating costs











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14" to 32" sizes for heavy manufacturing operations or sensitive tool room work

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Whether it's burrs in a dog's coat, or *cutting oil snarls* on your production line . . . there's no substitute for practical assistance when the going really gets tough.

And ***PRACTICAL TECHNICAL ASSISTANCE*** is a Cities Service specialty.

Cities Service Lubrication Engineers can offer every machining operation practical assistance that will mean dollars, man-hours and equipment saved. These specialists recommend the most effective lubricating practices, and they offer the most complete line of quality cutting fluids.

BUT CHECK FOR YOURSELF:

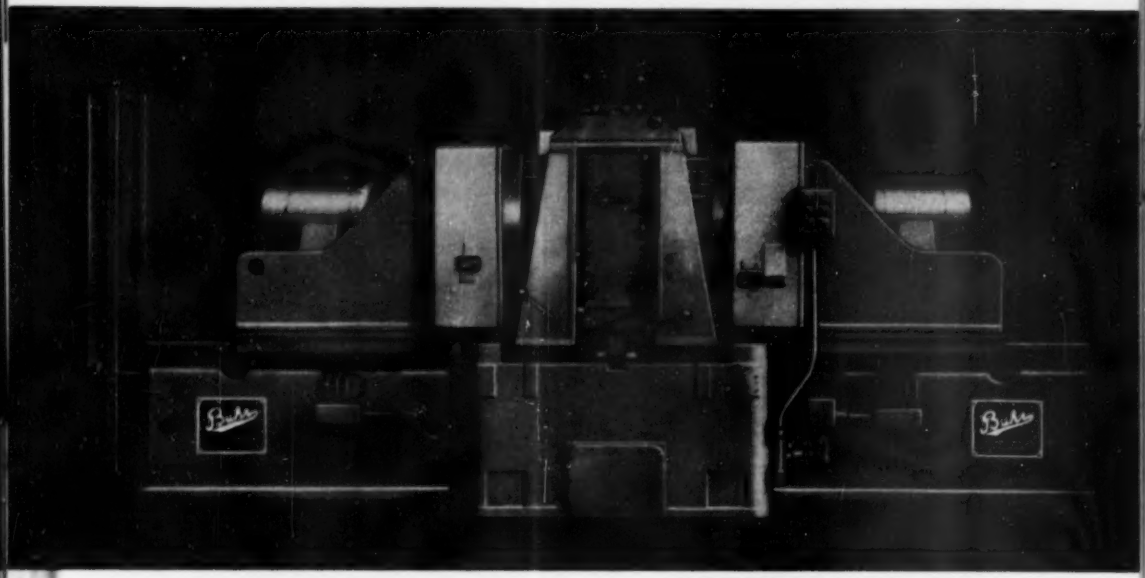
✓ Check on the high quality of all Cities Service Cutting Fluids. Check operations similar to your own, or, better still, test them on the job.

✓ Check the *complete* Cities Service line. It is the ideal, single source for the correct cutting fluid for every need. Deliveries are quick, accurate and dependable.

✓ And finally, discuss your problems with a Cities Service Lubrication Engineer . . . he's probably solved many like them in other manufacturing plants. Write or phone CITIES SERVICE OIL COMPANY, Dept. C37, Sixty Wall Tower, New York City 5 . . . or get in touch with the office nearest you.

CITIES SERVICE

HERE IS WHAT STALIN HATES!



It's not tanks, planes, guns, ships, atomic bombs and armed forces that Joe Stalin hates . . . It's the productive power behind them—productive power that is symbolized by this Buhr Two-Way Hydraulic-Feed Drilling Machine which is now hard at work day-in and day-out . . . helping one of the world's largest manufacturers turn out automatic transmission cases for tanks . . . This kind of Machine —more than anything else—is what Stalin hates.

Industries Turn to Machinery Like This . . . which Performs 93 Operations at Once

To help stymie Stalin, one of the world's largest engine makers was awarded an enormous defense order. Production had to get under way as quickly as possible!

One of Their Problems

To drill, ream and chamfer this automatic transmission case—that was one of the problems.

To handle this very important phase of their production, they turned to Buhr.

What the Machine Does

In general—it drills, counterdrills and countersinks 41 holes in front end of transmission case . . . and drills, counterdrills and countersinks 52 holes in rear end of case.

Specifically, the Machine accomplishes this—

From the left:

Drills (1) 25/32" diameter hole through
Drills and counterdrills (28) #1 holes
Drills and counterdrills (8) #2 holes
Drills (1) 29/32" diameter hole through
Drills (1) 7/8" diameter hole 3/4" deep
Drills and countersinks (2) end cover dowels on vertical center.

From the right:

Drills and counterdrills (11) #1 holes
Drills and counterdrills (8) #2 holes
Drills (12) #3 holes through
Drills and counterdrills (12) #10 holes
Drills and counterdrills (1) #19 hole
Drills and counterdrills (8) #6 holes

Production: 40 pieces per hour at 100% efficiency.

Why They Turned to Buhr

Buhr is an old and trusted friend by many of the leading U.S. Industries. Many have turned to Buhr for the past quarter-century. Their manufacturing facilities are excellent. In sales, engineering and production, Buhr has trustworthy and experienced staffs—staffs that are specialized in this field and able to service every part of the Country.

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This 48-Page Catalog . . . as well as one of our Sales Engineers . . . are at your beck and call. For every problem involving this type of Special Machinery—including defense production to halt Stalin—phone, wire, or write us.

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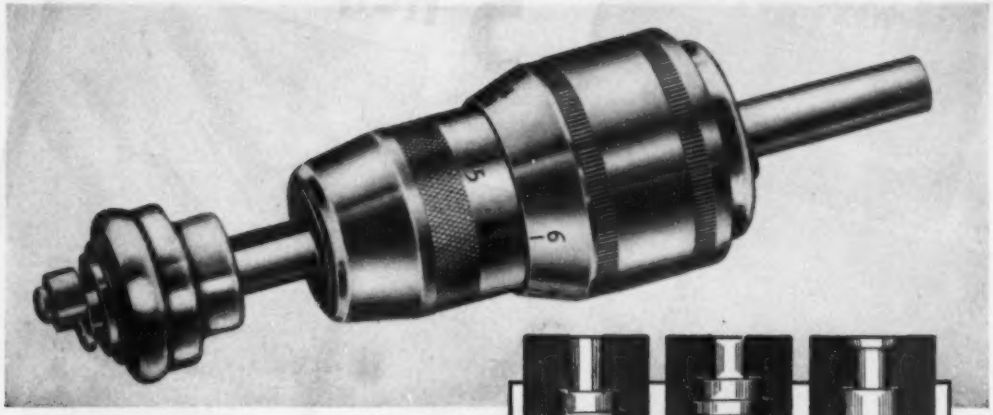
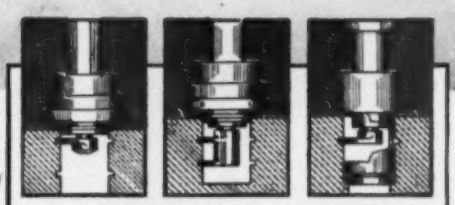
Buhr ***SPECIAL MACHINERY . . . Leaders Make Sure with BUHR***

Waldes Truarc Internal Grooving Tool

for precision cutting of internal grooves in bores and housings

FAST! ECONOMICAL! NEEDS NO SKILLED LABOR!





Groove located from top of hole | Double groove located from top of hole | Groove located from bottom of hole

Internal groove-cutting becomes the simplest of operations with Waldes Truarc Internal Grooving Tool. Easy to adjust—easy to operate...readily adaptable to individual requirements.

Designed for use in any hand drill or automatic drill press and screw machine... assures a concentric recess without injury to metal. Operates by fingertip pressure—especially suitable for unskilled operators.

The Waldes Truarc Grooving Tool when used in an electric or pneumatic hand drill, can be taken to the job eliminating disassembly and excessive handling...resulting in all-around savings in time and costs!

SEE IT DEMONSTRATED

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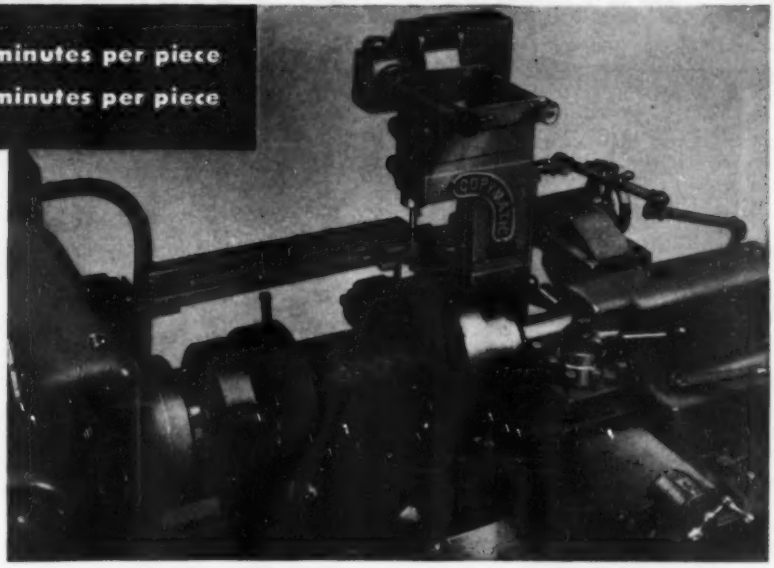
COPYMATIC USER REPORTS $14,000 ANNUAL SAVINGS

MACHINING TIME ON ONE JOB CUT 85%

...from 522 minutes per piece to just 82 minutes per piece



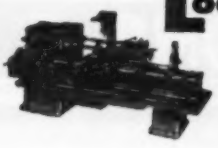
Turning the 500 lb. Prutton "Rollmaster" spindle. Due to the size and weight of the part, a flat template is used in contour turning before grinding.

Think of the savings when you cut almost seven and a half hours from a job that took a little more than eight and a half hours by previous methods! That's the astonishing record of a Lodge & Shipley COPYMATIC Lathe in service at the D. H. Prutton Machinery Co., Cleveland. The estimated annual savings are enough to amortize the machine in just one year!

In the production of the 500 pound spindle used in the revolutionary Prutton "Rollmaster" Planetary Thread Rolling Machine, machining time used to be 8 hours, 42 minutes. On the COPYMATIC, it's only 1 hour, 22 minutes. The operation is contour turning before grinding; the spindle is SAE 4140 steel; carbide tools are used at 240 feet/minute and .021"/ rev. feed.

In commenting on the COPYMATIC's performance, Mr. D. H. Prutton stated that the machine "is set up in 20 minutes, outproduces regular lathes four to five times and has excellent design features." On other spindle and shaft work, the COPYMATIC was described as "an exceptionally versatile lathe . . . enables us to make short runs in a fraction of the time formerly required.

Admittedly, an outstanding example of COPYMATIC productivity for profit, this 536% increase in production indicates the advantages COPYMATIC offers practically any shop. If you'd like more details . . . an explanation of how COPYMATIC combines the speed and convenience of automatic duplication with proven Lodge & Shipley "Model X" Lathe efficiency, write for Bulletin No. 675 and other case histories.



THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3059 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

SPLIT SECOND OPERATION

of "Automatic" Sprinkler Parts

Made on BARDONS & OLIVER Turret Lathes

At the "Automatic" Sprinkler Corporation of America, Youngstown, Ohio, 4 models of BARDONS & OLIVER turret lathes are used to produce high precision parts for the release mechanisms of sprinkler control valves to permit split-second operation.

Parts produced are of cast Bronze, Brass and Monel. Some intricate parts are bored, beveled and tapped at the rate of 26 per hour with high precision.

We are pleased that BARDONS & OLIVER turret lathes were selected for fast production with high precision in making the very intricate parts of the "Automatic" Sprinkler mechanism that requires split-second operation. Your inquiry or call for latest literature is always welcomed.

BARDONS & OLIVER, INC.

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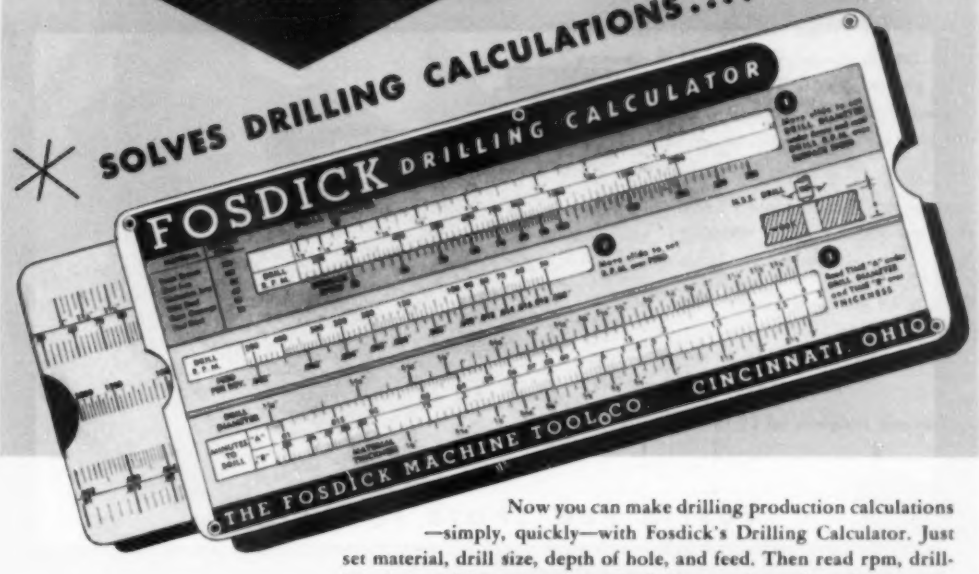
SEND FOR FOSDICK'S Free DRILLING CALCULATOR

SOLVES DRILLING CALCULATIONS... *Fast!*



Now you can make drilling production calculations —simply, quickly—with Fosdick's Drilling Calculator. Just set material, drill size, depth of hole, and feed. Then read rpm, drilling time, and horsepower required. In seconds you have the answers. *Fill Out the Coupon Today.* Send it to us and by return mail you'll receive without charge—the speedy Fosdick Drilling Calculator.

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The free Fosdick Drilling Calculator sounds helpful to me:

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RADIAL DRILLS
SENSITIVE AND UPRIGHT DRILLS
JIG BORERS
AUTOMATIC POSITIONING MACHINES
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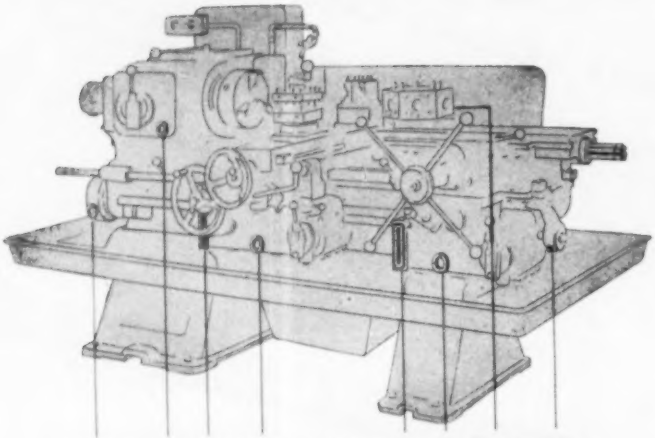
FOSDICK

another reason why J&L turret lathes produce { MORE CHIPS PER TOOL
MORE PIECES PER HOUR
MORE PROFIT PER JOB

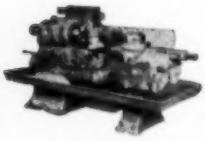


JUST A FEW SPOTS TO WATCH!

FEWER FITTINGS NO GREASE CUPS AUTOMATIC LUBRICATION

MORE EFFICIENT LUBRICATION!

Proper lubrication of J&L Turret Lathes depends very little on the operator or maintenance crew. This saves the operator's time and *cuts your maintenance costs.* The gears run partially submerged in oil, and independent pumps supply fresh, clean oil under pressure to *all sliding bearings.* Metering pins at each lubricating point assure distribution of the *proper amount of oil to each individual bearing.* Oil is pumped in direct relation to the spindle speed. This means that in High Velocity Turning with carbide tools—*when more lubrication is required—more oil is delivered.*



P.S. *This simple, built-in lubrication system guarantees your investment. Write to Dept. 710 for Catalog.*

"World's most accurate and powerful turret lathes"

RAM TYPES: Bar, 1½" to 4½", Chuck, 10" to 12". SADDLE TYPES: Bar, 2½" to 5", Chuck, 12" to 18".

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., Springfield, Vt., U.S.A. J&L TURRET LATHE DIV.

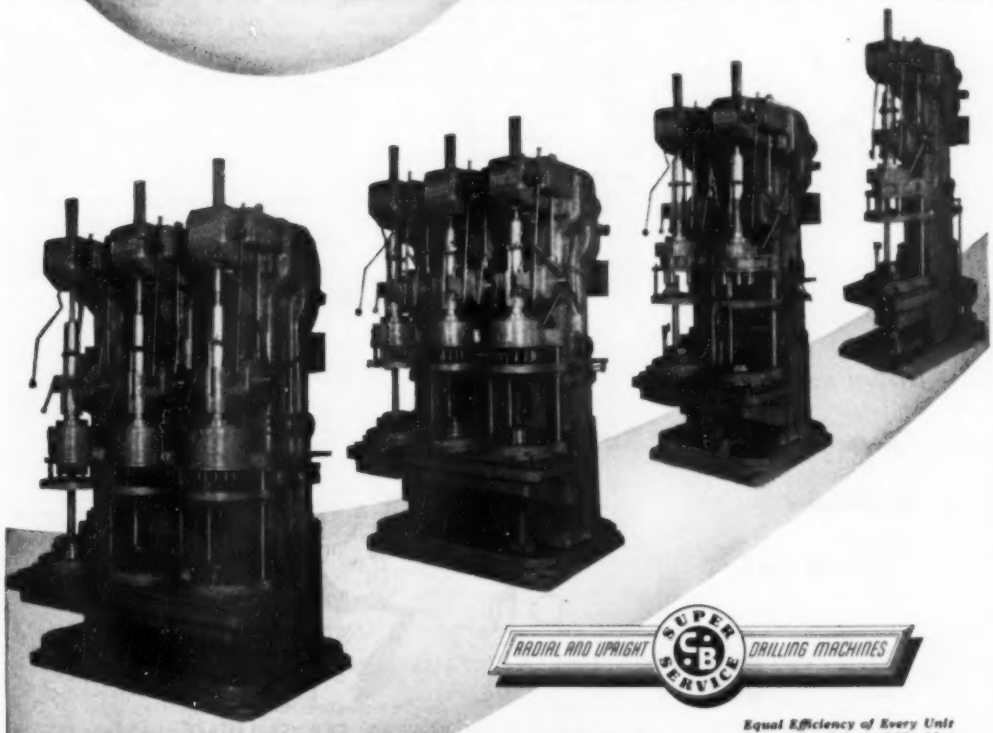
One a minute-

This battery of highly productive 21" and 24" Cincinnati Bickford Super Service Direct Drive Drills is drilling 24—.257" holes; tapping 24—$\frac{1}{4}$" holes; step drilling 4—$\frac{1}{2}$" x $\frac{1}{4}$" diameter holes $1\frac{5}{8}$" deep; tapping 4—$\frac{5}{8}$" holes in this crank case housing.

The operations are performed on both ends of three sizes of castings. All operations are completed at the rate of one a minute.

These Direct Drive Drilling Machines are made in the following sizes: 21" with 3 or 4 horsepower motor; 24" with 5 or $7\frac{1}{2}$ horsepower motor; 28" with $7\frac{1}{2}$ or 10 horsepower motor.

Write for Booklet U-27 for complete description.



Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Even the smallest size Reamers are Standard with L & I

The Reamer Specialists
LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Hobbing or Hubbing?

What's in a name? Frequently a lot of confusion and misunderstanding. For example, in a recent advertisement (*AM*, Jan 7) a company extols the merits of its hubbing press. On the opposite page is an advertisement for a hobbing machine.

It is true that the term "hobbing" was first applied to the kind of work done by these presses, and thus they may have a prior claim. But common usage now applies the term to the process of making gears by continuous cutting. Perhaps it was unwise to apply the word "hobbing" to the gear-making process in the first place, but it is now firmly established and in much wider use in that sense than in the sense of forming impressions by extreme pressure.

To avoid confusion, it would seem wiser for the makers of presses and users of the process to adopt the term "hubbing" instead. Many already do use it, and it clarifies the situation as to the machines and processes involved.

Some have used the term "force" for the tool or punch which makes the impression, and it has been suggested that "forcing" might cause less confusion than "hubbing." However, this might be confused with force fits or some forms of hydraulic or pressure forging, so it would seem that "hubbing" is the best solution.

Fred H. Colvin
Point Pleasant, N.J.

Black Aluminum

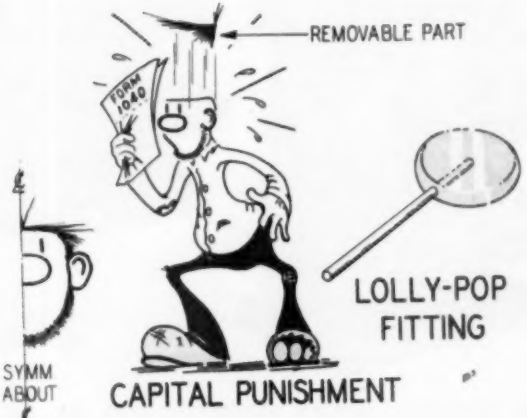
Can you suggest a simple and inexpensive way of producing a good black color on aluminum? I have no facilities for any electric or controlled heat process, but want some dipping process for small objects.

R. T. Jacobsen
Minneapolis

There are commercial products available, but if you want to make up your own solution, dissolve 1 oz of white arsenic and 1 oz of iron sulfate in 12 oz of hydrochloric acid. Then add 12 oz of distilled water. Clean the work with fine emery, wash, and immerse in the solution until the black deposit is deep enough. Dry in fine sawdust, and lacquer. This will work, but be mighty careful—you are dealing with dangerous chemicals.—Ed.

GRINETICS

BY D. G. SMITH



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Tandem bearings made

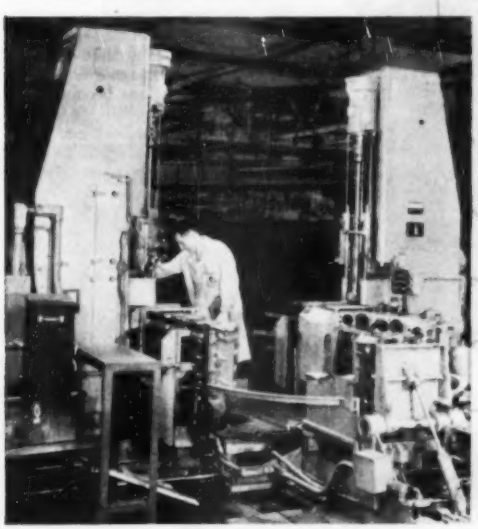
ROUND ★ STRAIGHT ★ IN LINE

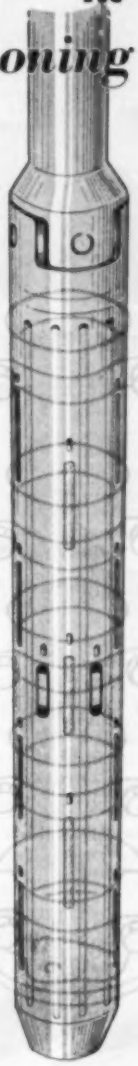
with NEW *Microhoning tool*

ALL FIVE bearings in V-8 cylinder block MICROHONED within .0005" for diametric size, roundness, straightness and alignment.

Plastic guides stabilize tool and control cutting. One bank of abrasives MICROHONE all bores.

This double column Model 740 machine equipped with new guided type MICROMOLD tools MICROHONES Main Bearings in 60 blocks per hour, removing approximately .002" stock from the diameter of each bearing. The blocks are automatically taken from the line, conveyed to either of the columns, and MICROHONED. The operator makes occasional spot checks as the blocks leave the machine.





Write for Cross Hatch for complete story on MICROHONING Interrupted Surfaces.

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what products do you make that need *permanent*

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NOBLEWEST RAPID PRODUCTION EQUIPMENT WILL MARK THEM FASTER • BETTER • AT LOWER COST

Because Noblewest has kept pace with industry's demand for constantly higher marking speeds and lower costs per unit marked . . . Noblewest is, today, the world's leading manufacturer of rapid precision equipment for the permanent marking of metal, plastic, hard rubber, wood. Model 157 (illustrated), with new improvements, can be tooled for marking many sizes and shapes of pieces.

Noblewest is equally famed for fine marking dies . . . made to the most exacting standards of quality and with the all-important skill and know-how of master craftsmen. For good impressions and long service, only the very finest of steel, carefully heat-treated, is used.

Whatever your needs for marking, Noblewest makes the machines, tools and dies to do the job faster, better, at lower cost. For complete details write to Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

A MARK IS ONLY AS GOOD AS THE DIE THAT MADE IT

MARK IT BEST WITH NOBLEWEST Roll-O-Matic MARKING

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

Belgian Beef

In "Spot News of Metalworking," (*AM*, Dec 10) I read "Big problem in U.S. vehicle-rebuilding depot in Germany is getting German mechanics to work to close tolerances required by U. S. Army specifications. This comes as a shock to Americans who remember stories of the German craftsman and his very precise work."

Comes as a shock to this Belgian subscriber, too. I have no love for the Germans, but any fair-minded European reader who reads the amazing bit of information above can only smile tolerantly, or blow his top, according to his type.

My previous experience as "native personnel" working for these G.I. experts tells me that the German mechanics in question were probably hired solely because they can speak some English, regardless of professional qualifications. I just cannot believe that German mechanics (by trade) cannot do anything the G.I. mechanics can do.

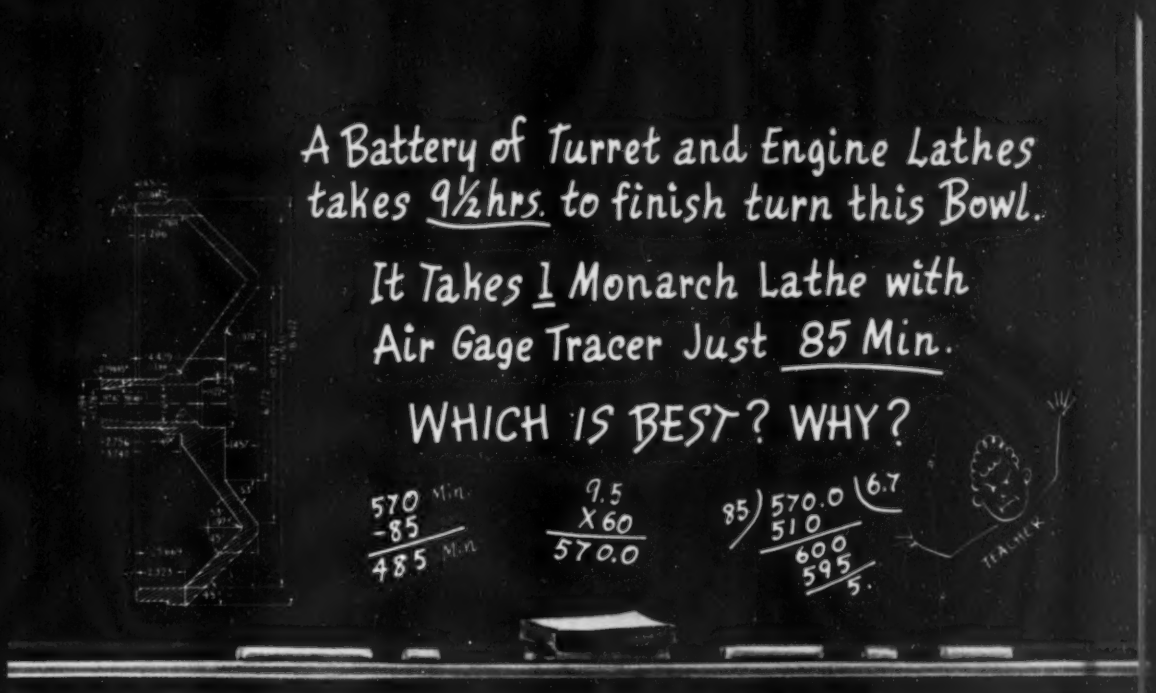
A. T. Renson
Atlanta, Ga.

You have probably hit the nail on the head in your supposition that the men were hired without too close a check on their abilities. After all, we have only to look at some German precision machines like the planetarium instruments, or the optical equipment, to know that we have no monopoly on craftsmanship. —Ed.

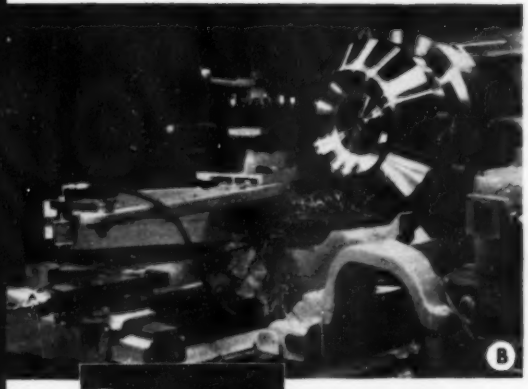
Permission Granted

The value of a magazine depends on its service to its subscribers. As a subscriber since 1902, and very occasional article contributor, I clipped the article on estimating costs (*AM*, April 11, 1946), as it had worked out the effect of quantities on cost consistently and more accurately than I had.

Recently it was very valuable where, on a war contract, parts estimated in lots of 50 had to be put



Simple Arithmetic!



STAINLESS STEEL CREAM SEPARATOR BOWL JOB REPORT

MATERIAL—Rough-turned stainless steel forging. EQUIPMENT—Monarch 25" Model N Heavy Duty Lathe with Swiveling Air Gage Tracer. OPERATIONS—1. Turn O.D. Turn hub and face to reverse taper (2-section template). 2. Change template—face rim and turn reverse taper (Figure A). 3. Turn work, change template—rough inside taper, finish turn complete, bore (Figure B). Same 2-section template used for all three cuts.

HOW DO YOU EFFECT SAVINGS LIKE THIS? With the Monarch "Air-Gage Tracer" PLUS, in this case, the exclusive swiveling design. For efficient cutting tool action on a wide range of planes during a continuous cut, there's nothing else like it. Even including work-handling time, floor to floor time of 85 minutes is easily maintained. This is due to the automatic accuracy of template contour duplication . . . ease of set-up . . . simplicity of tooling and tool change.

HAVE YOU TURNING OPERATIONS THAT YOU'D LIKE SIMPLIFIED? Monarch Lathes range from the 10" Model EE Precision Lathe to 32" Heavy Duty Turning Machines—most of which we can provide with any one of our *three* types of Tracer Controls. *You* know the kind of guts and accuracy we build into Monarch Lathes. Let us show you what they can do with Tracer Controls. Just detail your job . . . . *The Monarch Machine Tool Company, Sidney, Ohio.*

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

FOR A GOOD TURN FASTER...TURN TO MONARCH

taps won't break...

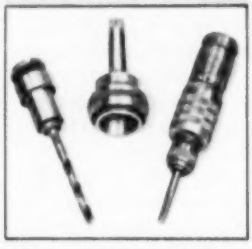
...Wickman Combination Tapping Attachment

- Applies Safe Torques ALWAYS
- Saves Taps, Labor, Materials

Here's an effective remedy for tapping headaches—a positive, safe tapping attachment with an entirely new clutch principle. This tapper guarantees your taps against breakage because it replaces coiled springs with a resilient material 100 times more effective than steel.

The Wickman Combination Tapper safeguards taps even in blind hole tapping; high resiliency of the pressure unit permits the clutch to slip the instant the tap strikes bottom or a hard spot. And, it's simple, too! Definite torque settings for given taps and tap sizes, without regard to materials being tapped, can be changed instantly without tools.

Wickman Tappers can be used on all reversible machines for horizontal or vertical tapping, blind or through holes. Three sizes are available: T-1, ½"-1¾" USS; T-2, ⅜"-1¼" USS; T-3, ¾6"-½" USF.



NOW—IMPROVED DESIGN GIVES NEW VERSATILITY, FASTER CHANGE-OVER

New features on improved model include a new detachable tapper shank holder with quick change lock for tapper or drill adapter. Change-over from tapping to drilling, counterboring, reaming etc. is made in a few seconds. No tools necessary. Send for free bulletin for full details.

THE Wickman MANUFACTURING CO.

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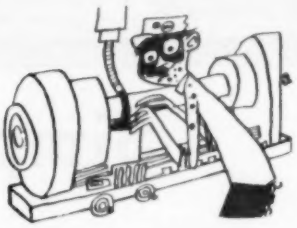
through in small, odd lots because of lack of complete fixation of design and a sufficient supply of all the needed components.

It was found that the costs were extremely close to the chart, and it was an authoritative base to show the ultimate user, who was not familiar with subcontracting.

We would like to have your permission to offer this to *Canadian Machinery* for reprinting in this country, with due credit to yourselves as the source.

H. B. Odell
Toronto, Canada

We are pleased to hear that this six-year-old article is still proving useful to you, and that you have found it to be so accurate. It will be quite satisfactory to suggest it as an article to Canadian Machinery *as long as we are given credit to protect our copyright.*—Ed.



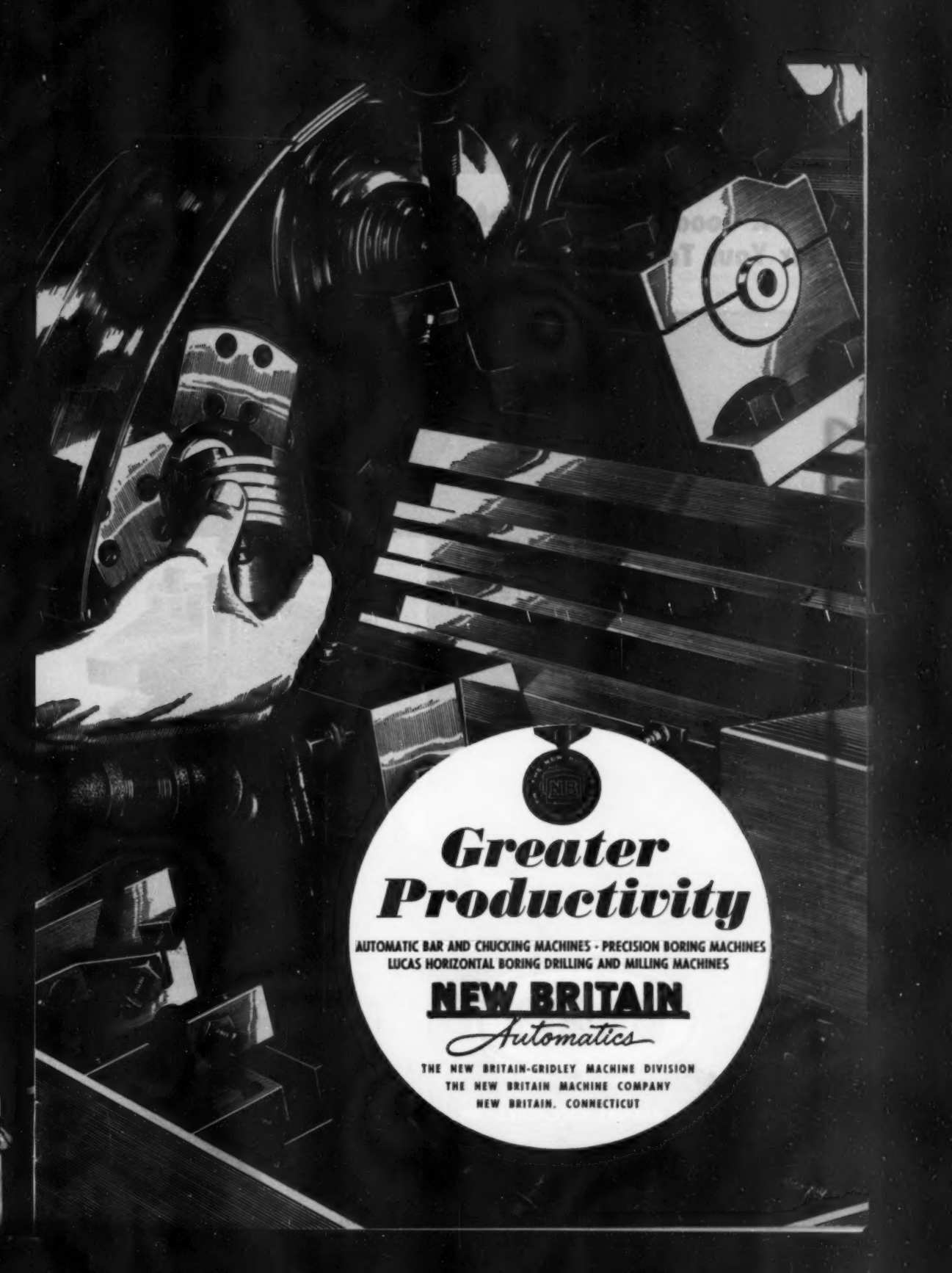
Red or Black

I was quite surprised to read in a recent issue (*AM*—Nov. 26, 1951), that American Machine & Foundry had added red dye to their cutting oils to make the oiliness of the work more apparent.

Their idea of keeping oil off workers' clothing has obviously failed, because, as you say, employees now comment on having red underwear. And as to workers dropping parts because they couldn't see they were oily—that seems too silly for words. Anyone who works around machine tools should expect work to be oily. And finally, oil companies have worked for years to produce a transparent oil, so the work can be seen clearly during cutting. If A M & F are interested chiefly in having a "visible" oil, why not discard their present and more expensive white oils, and buy one of the common dark oils? They come in all shades from amber to black.

I am not trying to plug the product of any of the oil companies—just offering a friendly suggestion.

A. L. Cantor
Chicago


Greater
Productivity
AUTOMATIC BAR AND CHUCKING MACHINES - PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING DRILLING AND MILLING MACHINES
NEW BRITAIN
Automatics
THE NEW BRITAIN-GRIDLEY MACHINE DIVISION
THE NEW BRITAIN MACHINE COMPANY
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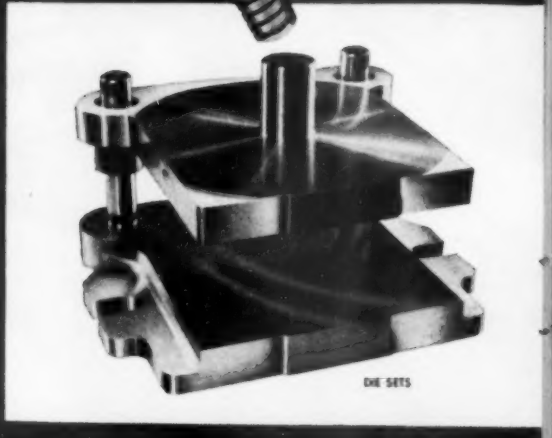
A Good, Fast Start for Your Tooling Program



DIE SETS

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DANLY

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SPOT NEWS of Metalworking

- **First off-shore procurement contract under defense program** went to Italians for Garand M-1 rifles. Contract, kept "under wraps" by Mutual Security Agency, calls for supplying rifles to 11 new Italian divisions. Italian industrial center at Colleferro will make .50-cal ammunition under another contract soon to be let.

- **New yardstick for giving higher price ceilings to entire industries** has been announced by Office of Price Stabilization. The yardstick: Any industry whose profits, before federal income taxes, are less than 10% of its net worth is entitled to an increase.

- **Three Bendix Aviation radar engineers are helping the British** recondition World War II lend-lease equipment, thus saving $16 million in European aid funds. The engineers are duplicating various components made in this country. After the British learn how to make these components, they will take over the job.

"Detroit Plan" of World War II for lending highly-skilled workers to other plants in greater need of them for urgent defense jobs has been approved by Wilson's Labor-Management Manpower Policy Committee. Automobile plants may be asked to farm out some key men until they can be fully utilized.

- **New process of making turbojet engine compressor blades** has been announced by General Electric to replace the relatively slow and expensive forging technique. Blades are rolled in long strips, contoured to proper air foil, then cut to desired length for assembly, principle being the same as that used in steam turbine blades. Base for blade was big problem. Way was hit on to make separate base with opening so that blade could be inserted and welded to it.

- **Low-cost plastic automobile body, molded in one piece and weighing 185 lb.** is product of Glasspar Co., Costa Mesa, Calif., and Naugatuck Chemical Division, United States Rubber Co. It is made of Vibrin polyester plastic and layers of glass fiber, is dent-proof and rust-proof, is available at $650 in one design to fit a frame with 100-in. wheelbase. Car will be shown for first time at Plastics Show in Philadelphia March 11-14.

- **Over $1 billion in machine tool orders is yet to be placed** by the armed services, according to Washington authorities, despite very heavy cancellations of machines by Air Force. For details on machine tools, turn to page 119.

A new automobile, the Justicialista, will be built in Argentina in a new factory at Cordoba. It will have a two-cylinder, 23-hp engine, will be 13 ft in length over-all, will weigh 1760 lb, is patterned after the German DKW. It will be known as a "criollo" car (home-made) and will sell for around $1000. Some 5000 will be built the first year.

- **Season of more big wage increases is on.** Automobile wages have just risen again. At General Electric, CIO wants higher wages in March 15 reopening, even before last fall's increase has been fully approved by Wage Stabilization Board.

- **UAW-CIO 291 must pay back wages to an employee of Wisconsin Axle Division.** Timken-Detroit Axle Co. Reason: local union forced company to dismiss employee for failing to keep up his dues, even though delinquency was before union got its union-shop contract.

- **Protests against placing up to $600 million of defense work in European plants** has been voiced by Commerce and Industry Association of New York, which says that 1100 machine and metal fabricating plants in New York metropolitan area are in need of defense contracts to fill up idle facilities.

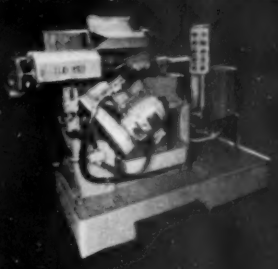
- **Steel companies have their salesmen out selling now,** knowing what lies immediately ahead. Some of steel makers with excess capacity for local markets are talking about going after customers they had prior to freight rate basing decision a few years ago.

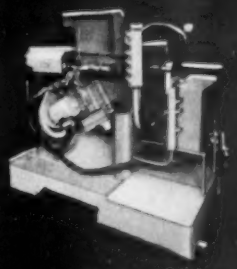
EX-CELL-O

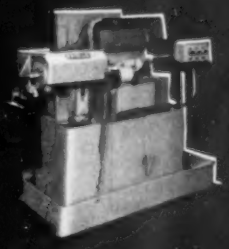
Blade Machining Equipment

NOW AVAILABLE

Compressor blade for turbojet aircraft engine.







Three Production-Proved Machines Mill, Grind and Polish Airfoil Forms

The complex job of finishing the airfoil form of compressor blades for jet aircraft engines is now done speedily, accurately, and automatically by three Ex-Cell-O standard machines. Production-proved, these machines mill, grind, and polish, respectively, with completely automatic machining cycles. Operator merely loads, unloads, and pushes start button. For further information and specifications contact Ex-Cell-O in Detroit today.

EX-CELL-O

CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS CUTTING TOOLS • RAILROAD PINS AND BUSHINGS DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Washington

Rebellion of the military against their budget ceiling of $52-billion for fiscal 1953 now is breaking into the open. If they win the fight for more money, the whole mobilization time table will have to be rescheduled again—for the third time.

• • •

The top brass are spearheading the scrap — the generals and admirals who do the planning for the three armed services. Arrayed against them are Defense Dept. civilian officials, who are supporting President Truman's slash in the $71-billion budget proposed by the Joint Chiefs of Staff.

Congress will have to settle the row. And it's expected to give the services—especially the Air Force—more money. What's worrying mobilization officials is: how much more?

• • •

Bigger arms spending means tougher controls, if it's much more than $52-billion. For example, in December the controllers figured on drastic cuts in metal allotments for civilian production starting in April. That was before military spending plans were slashed.

That deadline may be passed only temporarily. If Congress gives the services a big boost—say over $10-billion more—this summer, then more cuts for civilian goods will follow, for the fourth quarter, probably.

• • •

Best bet: Congress will compromise, give Air Force a substantial boost, the other services much less. In all, not enough to upset prospective allotment patterns.

Don't be fooled by the debate on arms spending. You'll hear a lot of talk about economy endangering national security. The Nation still is in danger, but a few billions more for arms this summer won't bail us out.

• • •

The Controllers didn't say so, but April-June allotments shape up as the toughest consumer hard goods makers will have to take. The re-scheduling of military production, enforced by the budget cut, means defense demands for CMP metals are now at peak. Actual arms output, because of lead-time lag, will be in 1953.

• • •

Civilian goods prospects are brighter than a surface look at second-quarter allotments will show. Major items—appliances, office equipment, etc.—will average 50% of their 1950 steel supply, 35% of copper wire, 30% of brass, copper forgings and aluminum. That's just 5% less copper and aluminum than they have for the first quarter.

Other consumer goods get more than they did in the first quarter. Venetian blinds, jewelry, builder's hardware makers are boosted from 20% to 25% of their pre-Korea aluminum, from virtually no brass to 10-25%.

• • •

And there'll be a real reserve of metal that DPA-NPA can dole out to keep hard-hit consumer goods makers in business. Reserves will be even larger in the third quarter, when DPA hopes to have allotments closer in line with actual metals supply.

You'll be able to carry over allotments—cash those you can't get filled now in the second quarter. And it won't be taken out of your April-June allotments. And DPA is cutting back on total tickets, instead of alloting more than total supply.

• • •

Don't overlook Small Defense Plants Administration —if you need help on a government contract, a defense loan or any other Washington business.

You are small business to SDPA if employment is under the average for other plants in your line. You can get an idea by asking nearest Commerce Dept. Field Office for its listing of small plants in every industry.

• • •

SDPA already is getting loans for small firms. It has an earmarked account with RFC of $100-million. RFC makes loans out of this on the recommendation of SDPA.

First loans provided working capital to smalls with defense contracts: $80,000 to a firm making army cots, $36,000 to a manufacturer of molded plastics, $155,250 to a maker of ammunition boxes.

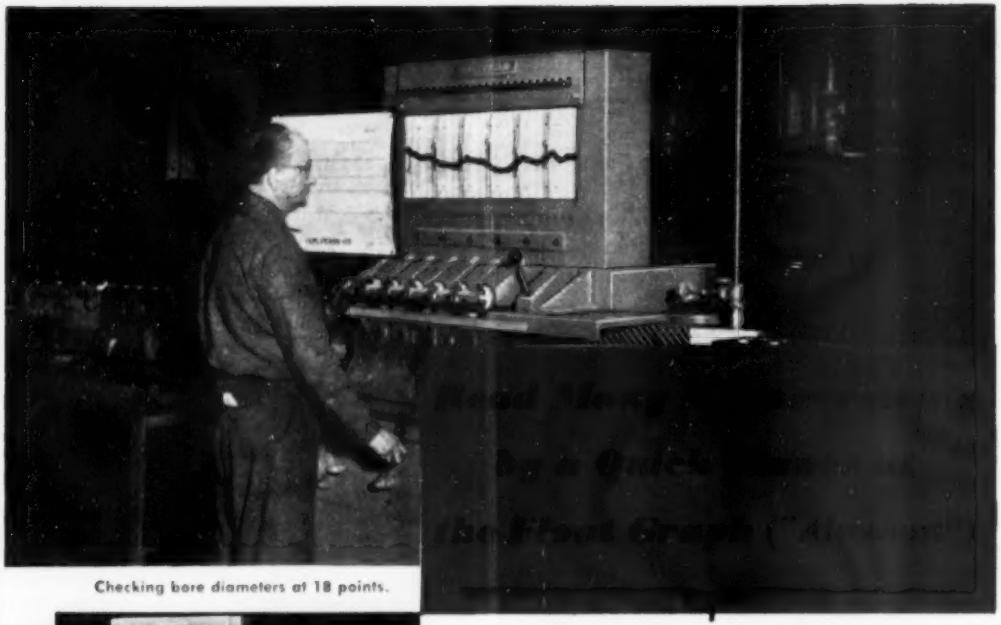
• • •

You get loan forms from RFC field offices. Ask for SDPA form 22 at the same time if you want help as a small. And you have to show you can't get the money from private sources on reasonable terms. It takes RFC and SDPA three to six months to check on your papers.

• • •

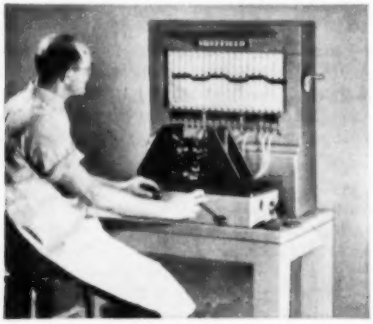
Government support of the all-union shop is a fact. It was recommended by a presidential Emergency board for railroad shop crafts and other non-operating employees. It's a good bet WSB will urge it in basic steel, too.

This will bring more pressure from all unions for the union shop in metalworking and other industries. Only 22% of unionized employees in electrical machinery work under a union shop contract; 42% in other machinery production; 51% in fabricated metal products.



Checking bore diameters at 18 points.

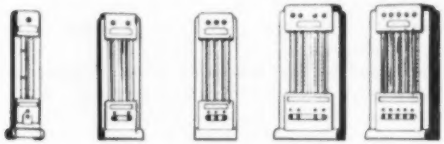
Checking 27 crankshaft measurements.



Checking contour of a turbine blade at 18 points.

Each individual measurement is indicated by the position of a float in its respective Precisionaire column.

The float positions form a characteristic pattern similar to a graph. It's actually a quality control chart. The inspector sees at one quick glance whether the work part can be passed or should be rejected, and for what dimensions. No eye strain, no close concentration, no figures to remember, no confusion of multiple dial faces with the "Airechart."



Standard Precisionaire column instruments are made with one, two, three, four or five columns. Special Precisionaires can be built to include from 6 to 30 or more columns depending on the number of dimensions to be checked.

For complete details on simultaneous multiple measurements with the Precisionaire, call your local Sheffield representative, send prints to us or write for Bulletin CTP-491.

the *Sheffield* corporation

DAYTON 1, OHIO, U. S. A.

Detroit

Chevrolet Division is understood to have stopped work on a new model die program. The reason: belief that the 1952 Fords had been changed extensively enough that the projected Chevrolet plans would not be sufficient.

• • •

General Motors has put together some statistical findings—the most effective evidence yet that the automobile market is a big one and will be a big one for many years to come. Here is the gist of the GM study:

Population has risen 15% in the last decade.

The number of households is up 25%. In the next decade it is expected to increase 25% more.

About 30% more people have become employed for wages in the last decade; in the next, a further 15% enlargement is expected.

• • •

Before the war GM figured there were about 8 million people who bought new cars. Today, that figure is set at 14 million.

In the past decade population in suburbs has risen 35%—creating car requirement pressures.

Disposable income has risen 24.4% since 1951.

• • •

New cars registered in 1951 total 5,060,903, against 6,326,438, the previous all-time record for any year, reached in 1950.

Students of market demand, meanwhile, found interest in fact that each successive 1951 quarter registered fewer cars than the preceding quarter, the slope running from 1.4-million in the first three months to 1.0-million in the last three.

From the look of preliminary and scattered registration figures during January, the down trend is likely to continue in the first 1952 quarter.

• • •

Production of truck and industrial engines began in mid-February in a completed portion of Chrysler's new engine plant at Trenton, Mich. A second unit of the plant is now being built —a single story, 504,000-sq-ft structure.

Production machinery began moving into the completed portion of the plant this month. Much equipment was moved from Highland Park. Trenton will build four Dodge truck engines, two industrial engines, as well as manufacture engine blocks, heads, crankshafts, pistons, other parts.

• • •

Union sources say that General Motors is trying to get another machine-tool contract to replace the recently cancelled Bullard job. The idea is, the sources maintain, that General Motors would like to use the facilities it had already set up and nearly got into operation on the Bullard assignment.

Education programs for unskilled workers are recommended by Ralph E. Cross, executive vice president of The Cross Co., Detroit machine-tool maker. In a television interview he predicted a lack of trained manpower to operate machine tools presently being built.

Two other Cross points: Defense production requires closer machining; military goods, built in smaller quantities than civilian needs, are calling for less automatic and less foolproof machine tools. The conclusion: Workers have to know more, must have more skill, to handle defense jobs.

• • •

About $50 million will be spent to build and tool a new jet-engine plant to be operated by Lincoln-Mercury near Romulus, Mich. Completion is scheduled for spring of 1953. This new Navy-owned facility, together with the fabricating facilities for jet engines going up at Wayne, Mich., will require about 2400 people.

When the Wayne plant is finished, assembly operations on Lincoln and Mercury automobiles now being carried on at the Lincoln plant in Detroit will be moved out to Wayne. The same personnel will be retained.

• • •

Surface finishes can now be standardized just as much as dimensions. General Motors and Chrysler jointly announced plans for distribution to all industry of precision reference specimens of surface roughness.

Chrysler and GM have been cooperatively working to develop such standards since the war. Replicas of the gold master specimen finishes developed by the two companies will be made by F. A. Ringler Co., New York City, whose electroplating process makes possible the precise duplication of the masters.

The first replica blocks will combine five so-called roughness values, now commonly used. Others will be prepared later. Negotiations are under way with surface roughness measuring instrument builders to include roughness specimens as calibrators.

• • •

Buying policy, on the basis of reports from purchasing agents, seems to be stabilizing more and more in the two-to-three-month area. There is only a trace of hand-to-mouth buying today, and likewise only a trace of buying spread beyond six months aged.

The purchasers report little current change in prices —if anything, during the past few weeks, the tendency has been downward, but it's hard to measure, it's that small.

General business, too, stays about the same, downward if anything.

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And with the numerous types of bases and tables available with Carlton Radials, you'll have all the hole production facilities you've always wanted.

Add to this the many Carlton design and construction advantages . . . and you'll find you can count on Carlton for capacity, production flexibility and performance. Why not send today for full particulars? The Carlton Machine Tool Co., Cincinnati 25, Ohio.

THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO

Gentlemen: Please send me bulletin(s) checked below:

- ☐ 1A— 9" col. 3'-4' arms
- ☐ 1A— 11" col. 3'-4'-5' arms
- ☐ 3A— 13" col. 4'-5' arms; 15" col. 4'-5'-6' arms; 17" col. 5'-6'-7' arms
- ☐ 4A— 19" col. 6'-7'-8' arms
- ☐ 5A— 22" col. 7' to 10' arms; 26" col. 8' to 12' arms

NAME_____

ADDRESS_____ CITY_____ STATE_____

Machine Tools

Very heavy cancellations of machine tools for Air Force tooling programs have hit the machine tool industry the past two weeks.

The British too have come through with sizable cancellations. It is perhaps unfortunate that their action coincided with the Air Force's, because there is no connection between the two.

Both special machinery builders and companies making standard machines have been affected.

One company is reported to have had over 300 machines rubbed off its schedule board. Another had 50 sizable units washed out. Others experienced equally serious setbacks.

• • •

The trouble is that a substantial portion of the cancelled orders were for delivery next summer and were well along in production. Machines had been completed and were ready for shipment, in certain cases.

Only special tooling, and not the machines themselves, was wiped out in some instances. Builders were told to hold the machines for further instructions later.

At least one builder, confronted with this situation, told the customer to accept the machines themselves immediately or cancel them along with the tooling. The customer thereupon reinstated the machines.

• • •

Biggest cancellations came from Ford's Chicago plant, which has practically abandoned its program for making piston-type engines for B-36's. This decision stems from the Air Force's decision to slash drastically its future B-36 production.

Ford's action affects a number of big special machines, which have been cancelled outright.

But Ford wants to junk just the special tooling on many standard machines on order, and later on use these machines with new special tooling to build jet engines.

• • •

An Air Force project at Frigidaire, which involves many machine tools, has been dropped altogether.

General Electric's jet-engine parts program at Louisville, Ky., is out, too. The plant will be tooled instead to make dishwashing units.

Jet parts manufacture at Terre Haute, Ind., has been affected, with machine tool cancellations as a result.

All of these cancellations come on top of the hold up and then the wiping out of the Fisher Body subcontract to build 757 Bullards for Air Force contractors.

This extensive cutting back of Air Force orders is part and parcel of a program for shaking down schedules onto a realistic basis. It is an aftermath, too, of overordering on a large scale.

Civilian mobilization agencies have been critical from the beginning of the Air Force's actions in placing orders right and left without knowing exactly what they would need.

This situation is not yet cleared up. The Air Force still doesn't have a clean-cut conception of what it must have.

• • •

Best information is that the Air Force does not intend to cancel any orders permanently except for programs which are to be completely abandoned. The Ford piston-engine and Frigidaire propeller jobs fall within that classification.

Other programs, like the Studebaker jet engine, are merely being lengthened out. Machine tools may be bought at the moment for only 60% of eventual capacity, tools for the remaining 40% to be placed later on.

• • •

Washington gives assurance that very large purchases of machine tools are yet to be made.

One authority estimates the amount conservatively at $1 billion, with a possibility that it may be $1.3 billion.

Both the Navy and Army Ordnance have big programs coming up. And the Air Force is said to plan further large purchases.

British orders here still number more than 6000 units. There is no reason to believe that they will dip under that figure. London is now in the process of placing a new batch of orders for 360 U.S. machines.

• • •

With many months' backlog for the machine tool industry still in force, and with large orders in sight (according to Washington), builders are being urged to keep up their high production pace in the months ahead.

January new orders were at 381 on the index of the National Machine Tool Builders' Association. Cancellations were 16.6% of new orders.

Shipments in January stood at 266.3. The industry today is operating at more than a $900-million-a-year rate.

• • •

Plan for stockpiling machine tools has run into a snag at Pentagon. The generals and admirals are reported to be opposed to it.

They cite the heavy cost, which would amount to several billion dollars. President Truman's recent slash in proposed spending for fiscal '53 makes it necessary to put all available funds into deliveries of end items, such as tanks, planes and guns, they say.

Defense Secretary Lovett's staff, nevertheless, is going ahead with drafts of legislation to set up a commission to do the buying and to provide the money.

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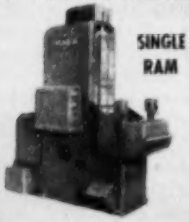
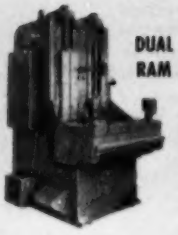
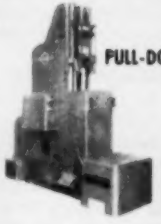


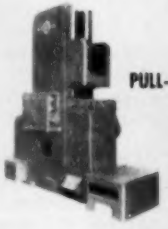
SINGLE RAM



DUAL RAM



PULL-DOWN



PULL-UP

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Check with us as to delivery time, based on your priority and need.

2. Look for Colonials IN YOUR PLANT

Check your present equipment. Possibly you have an older Colonial we can re-tool for a job more vital to you. We will be glad to help you cut the time of getting the machine on the new job.

3. Look around for USED Colonials

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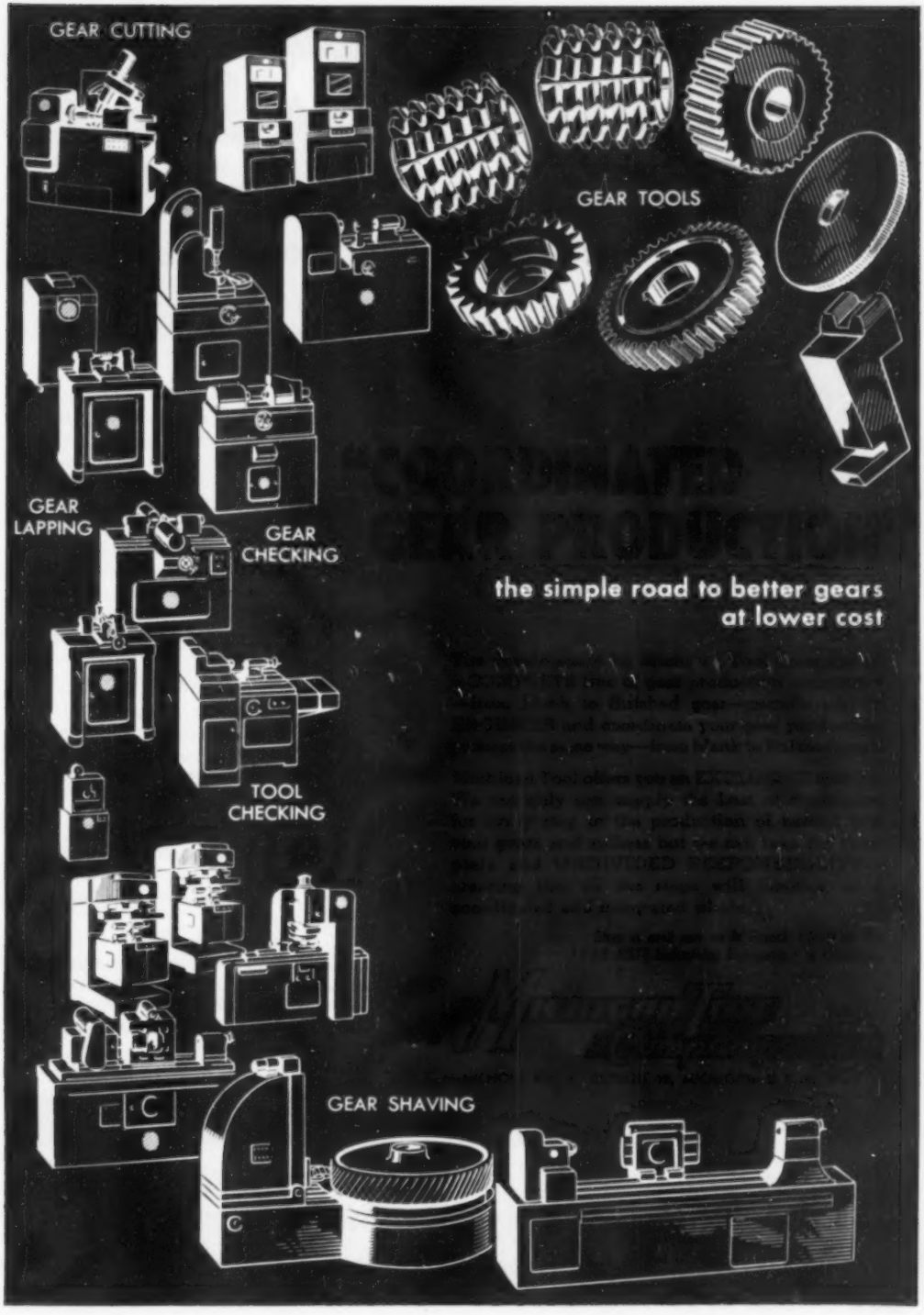
If it has received any kind of reasonable care, a used Colonial is still one of the best broaching machines you could buy.

Check with us as to its suitability for your job. We'll be glad to work with you in re-tooling it.

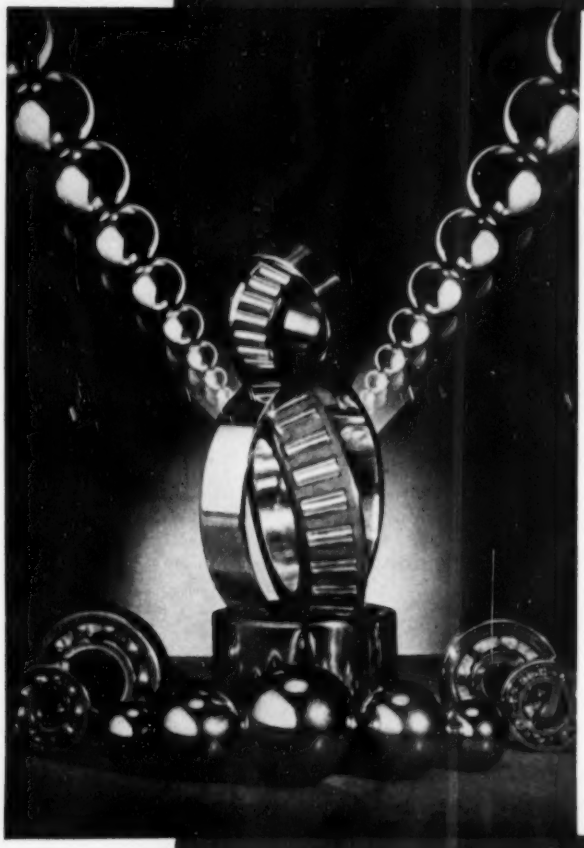
PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO DETROIT 13


GEAR CUTTING
GEAR TOOLS
GEAR LAPPING
GEAR CHECKING
TOOL CHECKING
GEAR SHAVING
the simple road to better gears at lower cost

LESS DOWNTIME, MORE PRODUCTION



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The Texaco Lubrication Engineer studied thoroughly all the problems involved, then made recommendations which included changing from a competitive grinding oil to a 1-to-50 emulsion of *Texaco Soluble Oil D.* The change was made. Now production is up, costs are down because, with Texaco –

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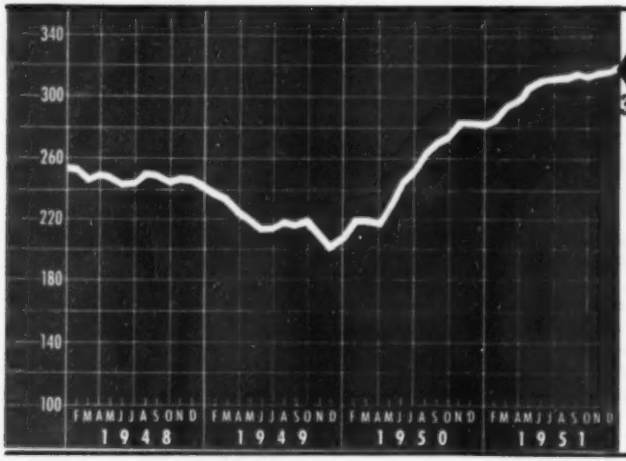
Gaging Metalworking



INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	FEB '52	JAN '52 (p)	DEC '51	FEB '51
	322*	**321p**	**318r**	**288**
Machinery	322	320	285	
Electrical Manufacturing	365	362	327	
Automobiles Trucks	219	219	241	
Transportation Equipment	493	487	313	
Other Metalworking	315	316	300	

* Estimated (p) Preliminary (r) Revised

Spreading out of plane production over a longer time (referred to as "Operation Stretch-Out") is not causing any alarm in Metalworking. Instead it has been greeted with relief by many parts makers, who say that they now will be able to meet schedules.

Major airframe companies report that their rate of expansion will be slowed down and hirings, in some cases, temporarily halted. No layoffs are in prospect.

• • •

Most contracts with suppliers and subcontractors have been rescheduled. But none has been cancelled.

Much the same story comes from makers of major plane components. Few will be able to pull back work into their own shops. They will be as dependent as ever on subcontractors.

Note one possible development, however: Metalworking companies with little or no defense work may bid more vigorously for available business from now on.

• • •

Metalworking continues its slow but persistent expansion.

American Machinist Index is estimated at 322 in February (based on manhours worked). That is one point higher than the preceding month.

It is four points above December. The comparison widens, however, when one looks back a year. The index rose 34 points in 12 months.

• • •

It's easy to figure out what is responsible for the gain. The "transportation equipment" (other than automobiles) component is up sharply, from 313 in January, 1951, to 493 last month.

The broadening of activities in aircraft manufacture tells the story.

"Machinery" and "Electrical Manufacturing" are two components that have moved up.

• • •

The tip-off of what's ahead is the announcement of slightly larger allotments of metals to civilian-goods makers in the second quarter.

The amounts are small. But the significance is that the worst of the materials pinch is here and soon will be eased, as military production is lengthened out and is not pushed up to a peak so fast.

• • •

Output is rising in both raw materials and finished products. Take steel. Mills turned out more tonnage in January than in any month before in history. This record pace is continuing.

For first time in months, however, scrap is being offered Cleveland district steel mills at less than the ceiling price. Also, some of non-integrated sheet mills have reduced production schedules to 4-5 days a week.

• • •

As steel supply eases and aluminum production grows, more consumer items will be made. And that promises well for last half of '52.

Employment is growing in many centers, but more particularly in those in which considerable defense work is concentrated.

Offsetting this is the unemployment problem in such big-city areas as Detroit and New York.

An estimated 6000 more workers will be needed by mid-spring in primary metals, machinery and transportation equipment fields at Cleveland.

Gaging Business

Industrial operations have moved sidewise since the first of the year.

Industrial output, measured by the Federal Reserve Board's index, stays at 218 (1935-1939 = 100). It has been close to that level for the past six months.

It's worth noting, though, that both January and February were below the same months a year ago.

• • •

The seasonal jitters have been with us lately. Look at the mild shake-out in the stock and commodity markets.

But commodity prices should start to firm up soon. And steel prices will be kicked up as a new wage agreement at higher rates is worked out.

Industrial production is likely to climb as the year wears on. Reasons: (1) Consumer goods will be in greater demand, and more materials will be available to make them; and (2) military production should grow.

• • •

Wholesale prices of industrial goods are about 3% below mid-1951 levels. But machinery prices are heading up.

Metalworking equipment and machinery prices rose about 3.5% from the middle of last year to January.

Pressure on prices, however, will be stronger in the spring and summer months. Any inflationary threat at that time probably will be short-lived.

• • •

Consumers continue not to spend their money. Meanwhile their incomes still are rising.

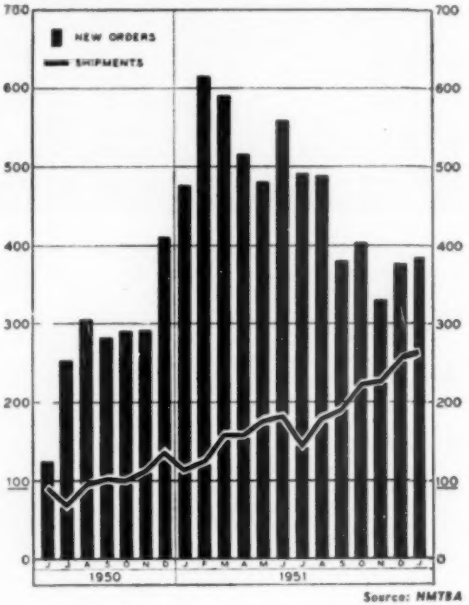
Factors ranging from psychological to high prices are responsible for consumers' choosiness.

Most of the shortages in labor are in skilled workers. Only a few centers haven't enough unskilled men.

Tool and die makers, machine operators and engineers are in high demand everywhere. West Coast aircraft companies still are trying to get men in Middle West, saying that they will pay "part" of moving expenses to California.

Machine Tool Shipments Rise Sharply

(Average Dollar Shipments 1945-47 = 100)



Source: NMTBA

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	236.0	236.4	235.9
Steel ingot operations (thousands of tons)	2,090	2,079	1,989
Electric power output (million kilowatt hours)	7,440	7,456	6,905
Production of automobiles and trucks	107,618	102,406	177,932
Engineering construction awards (*Engineering News-Record*—millions)	$222.1	$233.5	$223.8

QUARTERLY BUSINESS INDICATORS

	Latest Quarter	Preceding Quarter	Year Ago
Gross National Product (billions)	$333.0	$327.6	$303.7
Expenditures of new plant and equipment (millions)	$26,024	$23,376	$22,068
Profits after taxes in primary iron and steel industry (millions)	$162	$265	$270
Profits after taxes, machinery industry (except elec.)	$210	$297	$271
Profits after taxes, electrical machinery industry (millions)	$78	$126	$180
Profits after taxes in motor vehicles and parts industry (millions)	$171	$276	$448
Motors and generators new orders index (1936 = 100)	599.7	696.4	551.1

* Seasonally adjusted

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It's *sealed with pressure*—a revolutionary T-J application of flexible sealing that insures positive cushion action combined with automatic valving action for fast return stroke . . . eliminates binding and sticking . . . operates with *low friction, minimum wear,* and *added power* due to higher efficiency.

More PLUS features! New type packing nut incorporates a piloted diameter, assuring perfect alignment. Improved rod packing increases sealing efficiency. Piston rod and internal cylinder tube surfaces are hard chrome plated—a standard practice with T-J for over 15 years. Basic design is safety-stressed for air line pressures up to 100# PSI. Write for bulletin 252 . . . The Tomkins-Johnson Co., Jackson, Mich.

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2. Wrench flats.
3. Self-adjusting chevron type packing.
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5. Hi-tensile tie rods.
6. Heavy duty, hard chrome plated rod.
7. Generous fillet reduces stress concentration.
8. "O" ring static seal.
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10. Fine cushion adjustment.
11. Heavy wall precision honed hard chrome plate.
12. Controlled packing compression with metal to metal contact.

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Front cylinder cover for popular automobile engine.

FIRST CYCLE

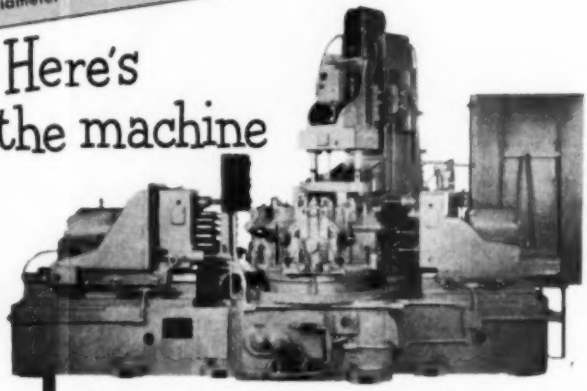
Station 1: Load on piece
Station 2: Horizontal Head—
Drill 3 holes 5/16" diameter
Drill 8 holes 13/32" diameter
Bore 1.80" diameter
Station 3: Horizontal Head—
Drill 4 holes 13/32" diameter
Chamfer 3 holes for 3/8—16 tap
Drill one hole for .1563 diameter ream
Station 4: Horizontal Lead Screw Tap Head—
Tap 3 holes 3/8—16
Ream one hole .1563"

SECOND CYCLE

Station 1: Transfer and load
Station 2: Horizontal Head—
Drill 3 holes .257 diameter for 5/16—18 tap
Station 3: Horizontal Head—
Chamfer 3 holes for 5/16—18 tap
Vertical Head—
Rough bore and chamfer 2.558" diameter
Section 4: Horizontal Lead Screw Tap Head—
Tap 3 holes 5/16—18 tap
Vertical Head—
Finish bore 2.558" diameter

Here... the cycles

Here's the machine



Illustrated is a MORRIS four-way machine with a 36-inch automatic indexing table. The 34-spindle machine performs a two-cycle operation with four two-position hand clamp fixtures. Produces 88 parts per hour at 80% efficiency.

If your work requires numerous drilling, reaming, tapping and boring operations on a mass production basis, your inquiry is invited.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Doing the Impossible

How wrong the boys are who said that metalworking techniques had gone so far that only "refinements" would be made from here on!

New developments are popping all over the place. They have been speeded by the defense program.

That program calls for outdoing Buck Rogers in the design and production of fantastic weapons. These weapons, Charles E. Wilson points out, change almost from week to week.

Many of them are operated by push-button control. Mechanisms do uncannily what human hands used to do, only more. They are accurate far beyond human power.

THEY HAVE BROUGHT new and challenging production problems. Tough new metals have come into being, metals which were believed to have been unmachinable.

But techniques have been invented to machine them. And other techniques have been devised to meet other equally difficult and puzzling situations.

Not all the problems, we might add, are concerned with defense. Some spring directly from fast-moving changes in the civilian-goods field.

Here are some of the developments which we are thinking about: The use of carbon dioxide as a cutting "fluid." It is being applied to "unmachinable" materials and heat-treated alloy steels.

Arc machining of exceptionally hard materials like carbides. Drilling and grinding of titanium. Carbide burs to do tough grinding jobs.

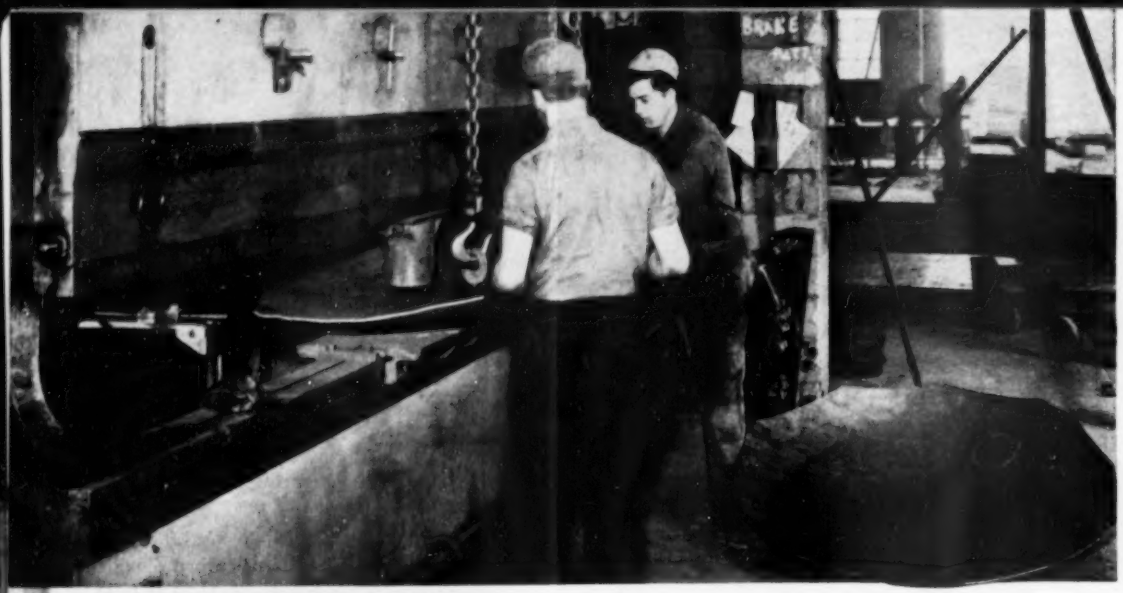
A new spark-gap contour follower and a punchcard blade miller (in connection with manufacture of experimental turbojet blades). A new process known as microbroaching.

ALL OF THESE DEVELOPMENTS, and others, are described in the editorial pages of this single issue of American Machinist.

But why go on? It becomes obvious that the days of doing the impossible in Metalworking are not behind us. Instead, they are with us right now. And the years immediately ahead give rich promise of further startling developments.

All of which gives added meaning to the statement that in the perfection of our technical processes, we still are in our pioneering days.

Burnham Finney



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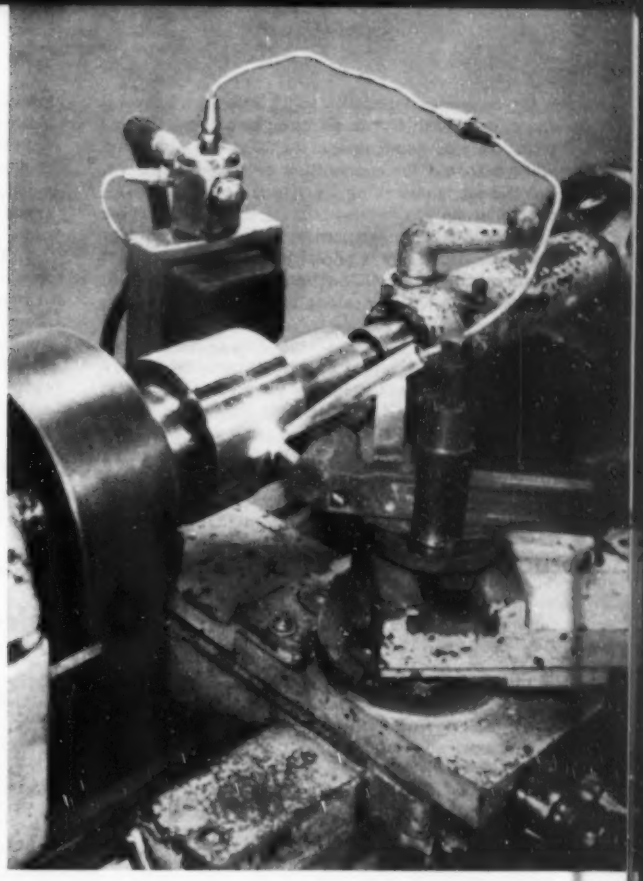


CO_2 COOLS TOOLS..

To Machine the "Unmachinable"

Intriguing among recent cooling methods is the use of solid or liquid carbon dioxide, particularly on hardened tool steel, titanium alloys, Hastelloy, Inconel, and high-nickel and chrome-cobalt compositions. An explanatory note precedes the developer's statement

BY E. J. TANGERMAN, EXECUTIVE EDITOR

RECENT developments of so-called "unmachinable" alloys, particularly for military use, as well as mushrooming of the types of materials in common use in civilian products of Metalworking, have focussed tremendous attention on the machining problems and given comparable impetus to the tool and cutting-fluid relationship.

Standard shop method of determining optimum machining speed has always been to assume it's just a little below the speed at which the tool burns out—or at which tool life is too short—another way of saying the same thing. One way to increase speed is to use cutting materials with greater red hardness: HSS, super-HSS, cast alloys, tungsten carbide. This course has been rather thoroughly explored by metalworking plants in recent years.

The other way is to find correct—or new—cutting fluids, new ways of delivering them, and to keep them cold. Thus, to the old familiar oil, soluble oil, and plain water, we have added sulfurized oils, special emulsions and solutions, other additives with special properties, even solids and powders. We hear of air cooling, mist cooling, jet cooling, no cooling at all, or even of spot heating. We've had refrigerated workpieces (*AM*, Feb. 19, '51, p. 112) that permitted phenomenal turning speeds, refrigerated coolants that took heat from the cutting zone. But one of the strangest of cutting fluids is a gas rather than a liquid, that old byproduct of common combustion—CO_2.

We have mentioned CO_2 as a cutting fluid several times, usually in cryptic paragraphs because the application was experimental or because some data were withheld for competitive or security reasons. But the intriguing thing about this method is that a change of state is involved. Thus, in heat-absorbing capacity, the heat required to convert the solid or liquid CO_2 to a gas is added to a large differential temperature (Solid CO_2 at sea level sublimes from —110 F at 14.7 psi by taking on 246 Btu/lb).

Advantages

Recently, one large manufacturer's laboratory suggested to us that CO_2 has six potential advantages:

1. Cleanliness—No spatter, oil smoke, or workpiece washing.

2. Temperature—Can be controlled, thus insuring dimensional and metallurgical stability.

3. Stability—will not combine with reactive and costly materials, (permitting chip salvage); prevents burning of chips during machining of pyrophoric materials.

4. Difficult Alloys—can be turned, drilled and tapped where other coolants failed completely. Many machining operations can be accelerated up to double present metal-removing speeds. HSS drills and taps can be used where carbide was previously required.

5. Tooling Studies—can be made to determine speeds, feeds, and tool angles without destroying one or more components of the test before results can be observed. Cools workpiece and tool without obstructing observation of work.

6. Tool Grinding—permits high-speed regrinding, even finishing of carbide tools with "green" silicon-carbide wheels instead of diamond wheels. Low temperature at surface minimizes grinding cracks.

Disadvantages listed were:

1. Economy—CO_2 as used in cutting is, at present, expendable. However, a typical job setup provides

Here's the story behind CO_2 coolant

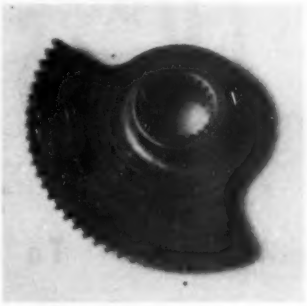
Any machining operation is simultaneously a metallurgical and a heat process. The extent to which heat is critical as a factor in cutting metal is currently being brought to light in the working of rare metals and alloy steels for jet turbines and other military components. Erratic behavior of certain metals and alloys undergoing work by methods that were valid with familiar materials is causing a change in basic concepts of machining.

Essentially, metals and alloys are chosen for special purposes to provide certain properties. While the stock may be delivered to the processor in proper metallurgical condition, many of these metals and alloys respond to machining adversely. Grain growth, workhardening, carbide precipitation, and the like occur as a result of the high temperatures occurring at the instant the chip is fractured. Common practice is to quench the cutting area to prevent rapid tool wear and burning. This, at the same time, quenches the unwanted structure and creates a surface area which differs materially from the original. Some austenitic steels become magnetic, workharden, and change in other properties to defy further working.

Intense heat, shown by measurement to be in excess of 2000 F, is created at the point of contact of tool and work. This is short-wavelength radiant energy with the same velocity as light. When this radiant energy strikes any solid or liquid, some enters the impinged materials while the balance is reflected. The amount of heat absorbed by the material on which the radiant energy impinges is proportionate to the means provided to remove it. The usual method of removal has been by conduction and gradual diffusion through a mass of liquid. Radiation is fast; conduction is slow. Heat which stays in the workpiece as a result of reflection and impingement will cause the metal to expand and thus affect dimensional tolerances. Also, the heat intensity may cause plastic deformation in the immediate cutting area.

Because the nature and value of the temperature of work and tools are directly related to cutting speed, finish, and tool life, many efforts to create temperature depressants have been made. Some of these aids refrigerate liquids to attain lower temperatures. This is effective in control of the liquid temperature, as in precision grinding, and, to some extent, lowers dormant heat in the work.

Thermal regulation of the cutting process is quite critical as to *time*. At 100 sfpm, more than a million fracture incidents occur in a homogeneous alloy each minute, each fracture creating friction, just as a cigarette lighter creates a spark, and releasing highly concentrated heat energy, just as a particle of abrasive does when it welds itself to the lens of a safety goggle. Another indication of the high and rapid release of energy is apparent ionization of immediately surrounding air and matter at the chip-tool interface, resulting in discoloration of the chip from oxida-



Hobbing, cutting and spline broaching are all done with CO_2 on this sector gear of SAE 1029 of R_c 27-32 hardness. The blank is hobbed 360°, then side-milled to a 150° sector, and spline broached. No burring is required, and chips do not weld to the broach. Hobbing time was cut from 14 to 8 min. side milling changed from hand to power feed

for use only during actual cutting. There will naturally follow, as use continues, a lower-cost source to make broad-scale application possible, and recovery of 12% of expended CO_2 is eventually possible. The present cost of CO_2 (as a solid) for modest consumption is $0.039 per pound. On one milling operation on 3.5% nickel steel, CO_2 increased production from 86 pc/grind to 500 (tolerance ± 0.0004). Production was up 32%, and a grinding and a burring operation were avoided. Cost for CO_2 was $0.009/pc.

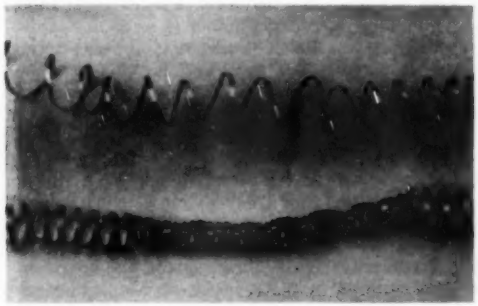
2. Evacuation—Ventilation adequate to move freed CO_2 must be provided in larger-scale applications. Worker consciousness of air contamination does not appear on present limited applications in closed rooms, because the gas is 50% heavier than air and immediately flows downward. CO_2 is not regarded as a poisonous gas, but experiments show that one cannot breathe air containing more than 10%. On the other hand, CO_2 appears to be the stimulant that acts upon the respiratory nerve centers in breathing. On this account, CO_2 is sometime added to oxygen (usually about 7% of the dioxide to 93% of oxygen) for treating cases of lung disorders, asphyxiation, partial drowning, electric shock, and, in general, suspended breathing.

3. "Burning" of Skin—Possible if an operator interferes with the flow of the expanding liquid. This is a remote possibility because the emission from a jet is seldom more than ¾ in. in length. As details of the process are explained during a training period, these incidents can be abolished.

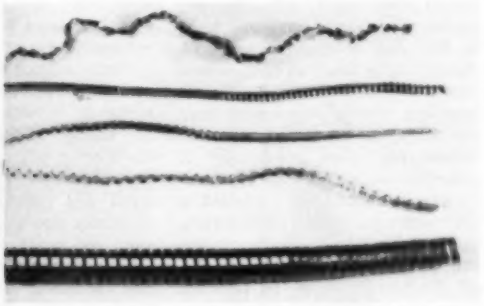
4. Capital Investment—for generating equipment is about $2500 in Detroit, a deterrent for small shops. About 4/5 of this can be capitalized, however, and multiple-outlet installations can be made.

For some months, we have been in contact with Paul E. Brunberg, whose CO_2 Development Company has made installations. Here, in an exclusive article, Mr. Brunberg describes for the first time the process and its effects.

as explained by... PAUL E. BRUNBERG, PRESIDENT, CO_2 DEVELOPMENT COMPANY



Dry-Cut (top) chip from 15% Cr, 15 Ni, 2.5 T alloy is straw-colored; heavier chip (below) cut with CO_2 is bright. Speeds and feeds have been more then doubled, with longer tool life



Titanium and monel can be cut readily. At top is a drill chip from titanium 150 A without CO_2, below are three titanium 150 A chips drilled with CO_2. Chips are clean and recoverable. At bottom is a K-monel chip cut at 390 sfpm with 0.021-ipr feed

tion and even a change in its chemistry and physical properties.

Carbon dioxide provides an effective means of coping with these conditions. In principle, liquid CO_2 is fed to the cutting zone at a rate necessary to maintain "room-temperature" conditions there—substantially counter-radiation of a heat-absorbing "sponge" to adjust the *time* element in the operation. A desirable byproduct is that a neutral atmosphere surrounds the cutting zone.

The mechanics of the process are: Pure, liquid, carbon dioxide is transported from a source under nominal pressure of approximately 850 psi through appropriate control devices to a jet (or jets) which are accurately constructed to measure output. Hence, sizes of jets are proportionate to the magnitude of the operation. Jets are placed in appropriate positions to meet the heat radiations of the cutting process. As the liquid CO_2 is emitted from the jet to the target, it changes its form to yield a major portion of its mass as finely divided solid carbon dioxide. Solid CO_2 exists at one atmosphere of pressure at a temperature of −78.5 C, and sublimes. The ability of the solid CO_2 to absorb radiant energy, induced by the wide difference in temperature, provides a balanced intercepting force for the heat of the cutting action, to make almost constant working temperature possible.

The carbon-dioxide process for machining has been widely applied in the machining of difficult alloys in defense establishments. Operations include turning, milling, planing, drilling, tapping, broaching, trepanning, grinding, etc., in all of which the work is dry and no additional agents are tolerated as contaminants of the carbon dioxide. Accordingly, when the work is completed, it is clean, dry, and ready for following processes.

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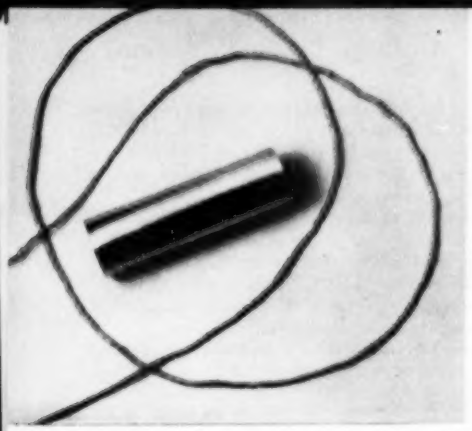


Alloy 25 (C 0.15 max., Cr 19-21, Ni 9-11, T 14-16, Si 1 max., Mn 1-2, Fe 2 max., balance Co). Problems are first, to cut it at all; second, to produce a finish. This sample was rough-cut with CO_2 at 190 sfpm, finished (chip shown) to under 15 mu-in. rms at 275 sfpm

Hy-Tuf (Crucible Steel Co) is typical of the aircraft alloys which must be finished in the heat-treated condition. Heat-treated to 238,000 psi ult tensile strength and 183,000 psi yield point, this sample had a Bhn of 495. It was cut dry with CO_2 at 155 sfpm for roughing, 440 sfpm for finishing (chip shown). Composition is C 0.25, Si 1.5, Ni 1.8, Mn 1.3. Finish is better than 13 mu-in. rms

Present Applications

Heat-treated steel can be machined readily with CO_2. For example, gear blanks hardened to 50 R_c are cut with HSS tools. A chrome-moly blank at 43 R_c is machined in 1 hr with CO_2, required 4 hr before. Three pieces are obtained per cutter, as compared with two cutters per piece previously. A close-tolerance 37 R_c SAE 4140 sector gear is hobbed 360°, profiled to 150° with a spiral mill (side cutting only), and a spline broached in the hub, all with an 0.012-in.-dia CO_2 jet. Profiling had to be handfed when conventional coolants were used, and chips welded to the broach teeth. A 4140 (R_c 40) spur gear on a shaft is now hobbed at twice previous speeds, with hob life increased from 2 pc per lead to 5-7 pc per lead.

Hadfield's steel (13% Mn) is being machined with cuts 3/16 in. deep at 0.035-in. feed and speeds of about 150 sfpm. The metal does not workharden and remains austenitic, permitting successive operations. On alloys containing 20-25% Cr, 10-14% Ni, and 2.5-3.5% T, speeds have been increased from 80 sfpm at 0.010-ipr feed to 300 sfpm at 0.020-ipr. Cutting is done on Bullards at room temperature without workhardening and to close tolerances.

Simpler stainless steels, such as 18-8 and straight-chrome alloys, are free machining, in all grades, at considerable speed. The former (18-8) is being rough-cut at somewhat more than 300 sfpm and finished at above 900 sfpm, at room temperature.

Items subject to successful and accurate machining include Hastelloy A, B, C and D; Multimet; and Haynes 25, as well as precision castings of other high-nickel and chrome-cobalt compositions. Inconel and Inconel X respond to roughing operations at over 175 sfpm and finish at over 250 sfpm. Milling operations on nickel-bearing steels have been held to 0.0004-in. tolerances in continuous production.

Titanium alloys such as 150 A respond to machining with CO_2 to render a valuable chip and without oxidation of the metal. It is significant that the process makes it possible to rough-cut 150 A forgings, through the scale, at speeds of more than 300 sfpm, cutting to a depth of 5/16 in. and feeding 0.010 ipr. Chip recovery, in a pure state, is important in machining these expensive alloys. Operations include broaching, lathe cutting, drilling, milling, and grinding. All work is accomplished at room temperature.

Descriptions of metals behavior are given above, but it should also be pointed out that tool life is extended by great percentages in the same manner, because tool mortality does not occur from heat.

Insofar as metals are cut at room temperatures it follows naturally that the expansion characteristics of the metal or alloy do not apply. Hence, burnishing is avoided entirely, and the tendency to extrude with a resultant burr is curtailed. Many types of gears are being cut on hobbing and Swiss machines without burrs.

Assemblies of dissimilar materials frequently create machining problems. For example, wound rotors are ground from the rough to finish dimensions in one operation with CO_2. The part is finished at room temperature, there are no heat effects on the winding, and there is better lamination separation.

The carbon-dioxide process for machining is somewhat different in application than former methods, and the technique of use and setup must follow certain patterns. Some of the descriptions given here lack identity of kind and shape of piece as well as plant location, because components are all military items under security restrictions.

Developments in process indicate further revolutionary advances in practice that will have an important bearing on choice of materials and tools which have been avoided heretofore because of machining difficulties. Process patents have been applied for in all principal free countries with all associated fittings and appliances.

TALKING SHOP

Rinso to the Rescue

BARDEN CORPORATION, Danbury, Conn., must drill nylon retainers for bearings without creating a burr. Holes are about 1/16 in. in diameter, are drilled almost like punching, at 30,000 rpm. A slow-spiral drill is used. But the cutting fluid is plain water with a little soap added. Any soap will work—even that in washroom dispensers—but the men prefer Rinso.

Gaging Today

PROF R L GEAR and A S Dispenza of the Dept of Material Processing at Cornell University, Ithaca, N. Y., have produced a 127-page mimeographed gage manual as an outgrowth of instructional work there. It illustrates more common industrial measuring devices and describes working principles, including latest procedures. A supplementary manual for more advanced study is being planned, covering "non-contact" inspection units, instrumentation of inspection in statistical quality control, and like subjects.

Bull Miller

A DOUBLE-HEAD MILLER for locomotive frames, recently completed for Indian State Railways by Craven Bros in England, has a baseplate 70 x 11¼ ft. It has two independent bridges, each carrying a vertical spindle with a 6¾-ft-dia cutter, and an auxiliary vertical head for cross-milling and machining holes and radii. The base is T-slotted, and bridges traverse along slideways outside it. Feeds by a 3-hp motor range from ¼ to 2½ ipm, power traverse is 12 ipm by a 10-hp motor. The cutter spindle has a 10-hp elevating motor and a variable-speed 25-hp motor for drive.

ASTE Control

TO PLAN AND HANDLE the technical program for the ASTE Industrial Exposition in Chicago, Mar 17-21, Frank Wilson, technical director of the Society, used production methods. He installed a visual production-control board to show daily status on confirmations of papers, biographical data, publicity material, reprints, and so on. All work on 50 papers and five 7-man panels was done two months ahead of the Exposition, so the idea had real merit.

Red Man Apprenticed

FOR MANY YEARS, American Indians seeking work away from the reservations could be employed only as common laborers because they had no craft training. Now, the Department of Labor's Bureau of Apprenticeship has established an apprenticeship program for Navajo Indians at the Arizona reservation. In cooperation with the Bureau of Indian Affairs, plus the Arizona and New Mexico Federations of Labor and international unions, this is the start of a long-range plan to be extended into other reservations to make the Indian more self-reliant. The program now launched will teach them the craftsmanship necessary to build schools and build and operate power plants and other industrial plants on the reservation, plus the skills needed for better employment "outside."

Studebaker 100

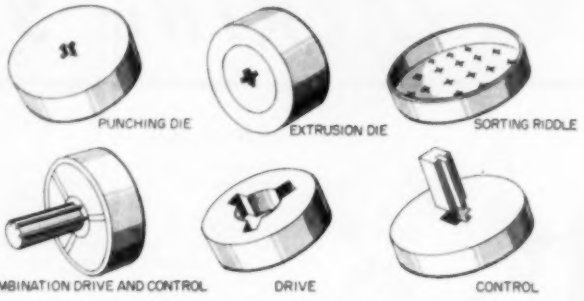
STUDEBAKER CORPORATION is celebrating its 100th anniversary. It started as a wagon shop with $68 capital, two sets of blacksmith tools, and Henry and Clem Studebaker as the only employees. First day's business was 25 cents—for putting two shoes on a horse. Today, capital is $65,000,000, there are 23,000 employees, and sales last year were over $500 million.

Ball Sorter

TO SORT bearing balls for size by ten-thousandths, Barden Corporation, Danbury, Conn., has built a knife-edge sorter. Balls are lifted from a hopper by a feed dial with holes around the rim. They are carried up to a chute, down which they roll to the knife edges. These are hardened tool steel, adjustable to vary the taper of the slot between. Commonest setting is with 0.001-in. taper in the 6-in. length. Balls within the 0.001-in. dimension drop through into chutes that lead to one of ten boxes, while oversize balls roll off the end of the slot . . . This unit, and a working gyro, were major attractions at the recent Danbury Industrial Exposition. Barden's booklet for the Exposition mentions, incidentally, that 50 foot-candles of lighting are provided at all working levels, and 35% humidity conditioned air is changed every 10 minutes. Current production is 200,000 miniature precision bearings a month, and the rate will be doubled this year.

Steel Here to Stay

JONES & LAMSON has been experimenting with titanium for die-head parts. Amounts have been so limited that no conclusive results have been obtained. But grinding the material causes sections to split off . . . Slow speeds and heavy feeds have been used during the searching periods: 55 fpm, 1/16-in. cut on a 1/2-in. side-mill; 47 fpm ⅛-in. cut, and 3-in. width of cut with a 4-in. cutter. Weight-strength ratios are all right, but titanium tends "not to slip freely" over steel, and wear resistance leaves something to be desired. Attempts are now being made to carburize, nitride, or oxidize parts for greater wear resistance, but the general impression thus far is that "steel is here to stay."



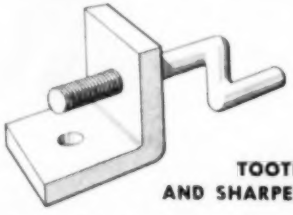
WHAT CAN BE DONE

The typical shape at top (4 times size) is produced in SAE 40 bronze 3/16 in. thick in one press stroke, starting with an 0.050-in. hole. Thus hole diameter is only a fourth its depth. Generally speaking, the larger the starting hole, the easier the job, so it's smart to use a larger hole if sections of its circumference can be part of the final shape. SAE 40 cuts easily, "irons out" nicely, and can be chrome-plated if considerable wear resistance is required. Broaches last indefinitely on this or similar material, but can be used with care for steel if only a limited number of pieces are required. Other sketches show some typical jobs

MICROBROACHING... new technique for tiny, odd-shaped holes

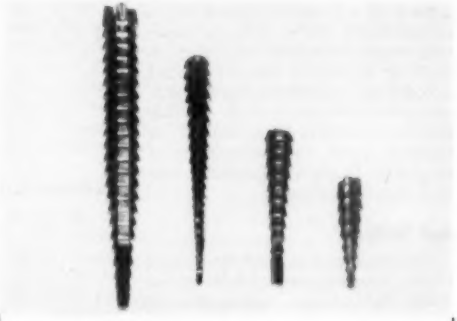
No longer need you shy off from irregular little openings—they can be push-broached. Developed for making hopper feeds for instrument parts, the method is broadly adaptable. Tools can be produced in any toolroom, parts broached one a minute by arbor press with a little care and experience

BY JOHN S. DENISON, President, DENISON INDUSTRIAL CORP., BELLINGHAM, WASH.



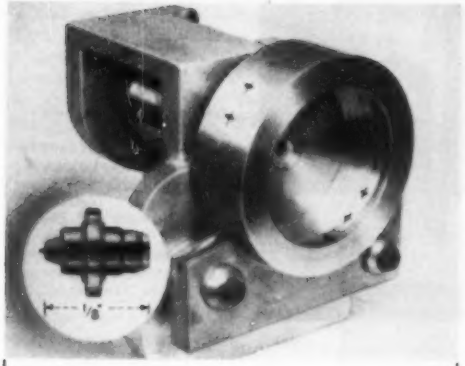
TOOTHING AND SHARPENING

The hardened blank is toothed and sharpened by hand on a small bench or floor grinder with a cut-off wheel beveled to 45° with a diamond. The gage sketched here is attached to the toolrest and the small end of the broach held horizontally against the end of the screw while teeth are hand-cut. The screw has a pitch equal to, or a multiple of, desired tooth spacing. First teeth are formed at the small end of the broach, then the screw is backed off, the next row ground, and so on. Depth should be only enough for chip clearance, leaving a small land on each tooth. Lands are later given clearance by hand on the same wheel. Tooth rows 3, 4, and possibly 5 from the large end are full size of the completed hole; 1 and 2 are relieved all over for easy broach removal; and the chucking allowance cut off



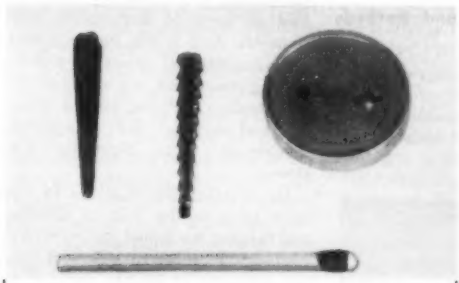
HEAT-TREATING

A blank is just barely gripped in a drillpress chuck, point down, and rotated at slow speed. It is heated with an acetylene torch, rotation insuring uniform heating and minimizing or eliminating warpage. When proper heat is reached, a coffee-can of quenching oil is lifted around it for the quench. It is drawn similarly to almost a blue color. Shown here are completed microbroaches of various sizes, toothed by hand as described next



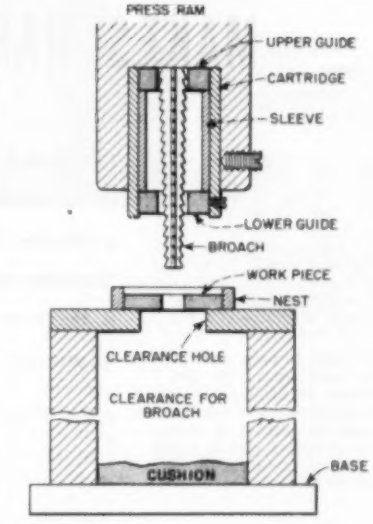
ORIGIN

This hopper feed for the tiny instrument part in the insert (longest dimension ⅛ in.) inspired development of microbroaching. Holes in the drum are broached so pieces can come out to the slide at front faced in one direction only. To get proper clearance on all cutting edges of each tooth of a miniature standard broach for the job would be prohibitively expensive. Micro-broaches need no relief except behind the top cutting edge of each tooth, where it can be done easily and quickly freehand. This shape limits applications only slightly



HOW TO MAKE A BROACH

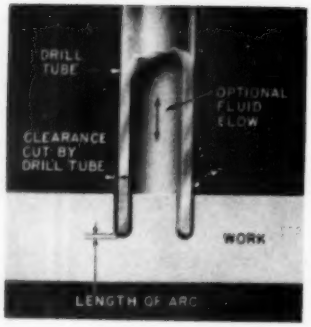
Broaches, which usually are about 1½ in. long, are made three at once from drill rod. The rod, three times broach length plus three chucking allowances, is held in an accurately indicated vise so half the cross-section can be milled. Small shelves milled in soft jaws serve as parallels to hold the piece for milling the other half of the cross-section and for further operations as long as the jaws are not moved. The piece is cut into three blanks, ground to a taper lengthwise (by hand on the side of the wheel) from about ⅝ in. from the large end to the minor diameter. No great accuracy is required. The blank then looks as at left above. Shown with it here is the finished broach and a workpiece with starting hole (this determines minor dia) and the broached hole. A good toolmaker can make three broaches in a working day



BROACHING

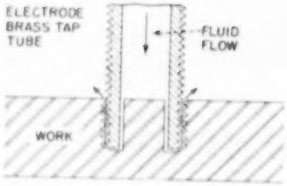
Broaches must be supported rigidly and perpendicularly at the start. To do this, the end of the arbor-press ram is bored to receive a cartridge like that above—about 2/3 the length of the broach. In the cartridge are two brass slugs previously broached by the same broach (but with large starting holes) and separated by the inner sleeve. The lower slug is anchored by a setscrew, and the two serve as guides to prevent the broach from buckling. The cartridge is positioned accurately in the ram and held by setscrew. An arch workholder is placed under the ram to provide clearance for the broach below the piece (sketch). The broach is inserted in the positioned cartridge (1/3 will project) and forced into the hole to be broached until the cartridge strikes. Then the ram is retracted, a flat piece of steel placed over the hole in the cartridge, and the ram lowered to push the broach on down flush with the work. It should then fall through—or is easily pushed through by a pointed tool, to fall onto a cushion. Setup must be absolutely rigid, with no play in ram and the workholding fixture sturdy

ARC MACHINING



Drilling of through hole in solid workpiece generally is done with tube electrode. Feed control maintains desired arc length (usually 0.00025 to 0.005 in.). Descending drill cuts own clearance (0.0005 to 0.007 in.) in workpiece and leaves "trepanned" center slug

MAKES HARD-TO-CUT JOBS EASY



Threaded holes through hard steel or carbide workpieces economically are produced by drilling and tapping simultaneously with a threaded brass electrode rotated in proper ratio with downfeed rate to match thread. For bottomed holes, core is broken off at bottom

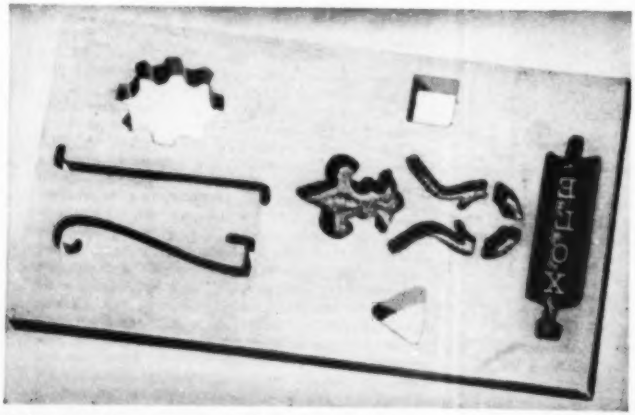
The broken-tap "disintegrator" shows promise as a broader-gage production tool, particularly on "unmachinable" materials. Here is the first detailed description of principle, tools, and methods

By H. V. HARDING, Chief Engineer
and
V. E. MATULAITIS, Research Engineer
ELOX CORPORATION OF MICHIGAN

ARC MACHINING removes metal from workpiece surfaces without physical contact between tool and workpiece. It substitutes carefully controlled, minute, intermittent electric arcs for the cutting bits normally employed in machining operations, and so eliminates any need for application of force to accomplish chip removal. And it can be employed for virtually all types of metal-cutting operations, including drilling, tapping, turning, boring, milling, and shaping. But, at present, machining rates generally are slower.

Its practical applications so far have been in the field of drilling and tapping hardened tool-steel die parts and sintered carbide sections, the removal of broken tools (i.e. disintegration of broken drills and taps), and experimentally for the fine surfacing of carbide toolbits. But this does not limit its field.

Current laboratory tests indicate that the arc-machining process—sometimes also called disintegration, electron drilling, electrical erosion, atom expulsion, and spark machining—soon may be applied economically to many other jobs. It has been applied already to the drilling and tapping of such materials as Alnico, the sintered carbides, nickel and chrome alloy steels, manganese steels, the cast non-ferrous alloys like Stellite and



Holes of varying contours and sizes are easily arc-machined. Bottoms of blind holes can be contoured by shaping end of electrode to suit. Contoured surfaces also have been produced with tracer-controlled small round electrodes

Tantung, cast iron, copper and copper alloys, aluminum alloys, lead, zinc, and many others.

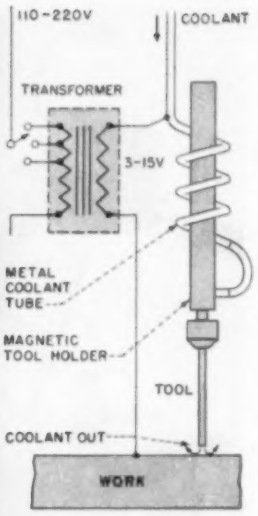
Arc machining is a relatively new process. Its life span to date is less than ten years. Developments of practical value in the field made little headway until Harding (Pats. No. 2,374,348, No. 2,383,382, No. 2, 393,383, and No. 2,441,319) and Holfelder (Pat. No. 2,415,690) in 1942 discovered procedures for using an electrical discharge for removing workpiece particles in preselected size and quantity while maintaining accurate dimensional control and leaving a good surface finish. Improvement in the process by McKechnie (Pat. No. 2,501, 954) resulted in better control and increased cutting rates.

Basically, the process consists of the development of a series of electrical discharges, called intermittent arcs (or, more improperly, sparks), between an electrode (the tool) and the surface of a metal workpiece in the presence of a fluid. Control of the instantaneous magnitude of arc current and voltage, relative duration of current flow and off time, and discharge frequency, along with other factors, are essential to determine the cutting speed, accuracy and surface finish to be obtained.

Because these arc characteristics can be controlled, workpiece particles varying in size from little larger than an atom up to the size of a pinhead and larger may be removed as desired. Workpiece material adjacent to the work area is not affected, as the discharge, confined by the fluid, results in only the minute local volume of material preselected being heated to the extremely high temperature of the arc. Temperatures of 18,000 to 27,000 F have been reported by some observers.

Generally, there is very little material removed from the tool electrode in proportion to the volume of workpiece material thrown off when using dc arc equipment, with the tool connected as the cathode (negative potential) and the workpiece as the anode (positive potential). The expelled material is continuously removed from the arc zone by forced flow of the fluid and by other expellant forces.

First arc-machining units used ac electric etcher circuit which consumed tool electrode as rapidly as hole was drilled. Placed on market in 1943, these ac units were hard to control and removed metal slowly. They have been superseded by more effective dc units



Early commercial ac arc-drilling heads, for removing broken tools from workpieces, had circuit using small adjustable-voltage transformer which fed current to tool and work through solenoid that alternately made and opened circuit by movement of toolholder relative to work

No actual physical contact between tool and workpiece is required, since the electrical discharge can be made to take place across a predetermined and constantly maintained gap between them, even at voltages as low as 10 to 15 volts.

Several theories have been advanced as to what takes place at the time of arc discharge in an arc-machining operation. This seems to be a reasonable explanation:

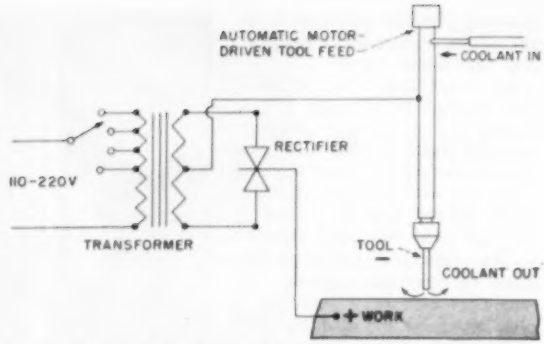
The tool, which is the negative electrode of the discharge gap, normally has a number of free electrons leaving and re-entering its surface boundary. If the voltage between the tool and the workpiece surface is of sufficient magnitude, there will then be a flow of electrons from tool to work. These electrons impinge on the work surface and agitate the molecules in the arc area to increase their movement. As mechanical molecular activity and temperature are synonymous, sufficient increase in molecular activity will cause solid material first to rise in temperature, then become liquid, then gaseous, with consequent tremendous increase in volume.

When this volume increase occurs quickly, it develops sufficient force to cause expulsion of material particles from the work surface. This expelled material is positively charged (shy of electrons, or ionized) hence is attracted toward the negatively charged tool.

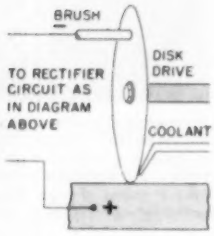
Fluid is therefore fed through the discharge gap to act as a buffer, minimizing the possibility of workpiece particles striking the electrode, and to wash them out of the cutting zone. Even so, a few particles will impinge on the electrode and gradually erode the tool surface.

Tool rotation, while desirable, is not necessary and the tool may be shaped to form an irregular hole in a workpiece, or to shape an exterior surface to the required contour. But where tool rotation is possible, it is preferable because a uniform approach of the tool to the

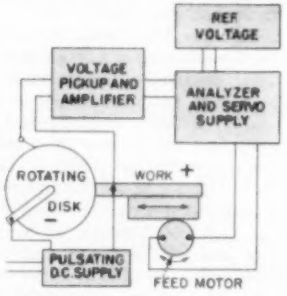
Self-contained Model M-10 Electron Drill was marketed in 1950 as a general-purpose salvage unit. It uses 36-in.-long tubular electrodes and has an automatic servo feed which maintains arc length within close limits. Head will drill in any direction



Rectifier in power circuit of Model M-10 and similar arc-machining units converts ac from transformer to dc so arc discharge between tool and work is polarized to minimize tool-tip erosion and increase machining rate. Coolant flows down through tool tube



Transformer-rectifier circuit easily is applied to rotating-disk or cup-wheel units for surface arc machining, sawing, or slotting. Disks and cups are shaped to contour



Addition of servocontrol to feed of work or tool as arc-cutting progresses improves arc-machining efficiency. In circuit shown, average discharge voltage is translated into tool positioning feed

workpiece surface is then assured even when the tool is not precisely centered. Rotation of the tool also minimizes buildup of discharged particles on tool surfaces, which may tend to bridge the discharge gap and cause a short circuit between tool and work.

There is no theoretical limit to the rate of material removal by this process, because there is no known limit to the amount of electrical energy that can be discharged between two electrodes in a given time. Practical considerations, however, such as available electrode materials, available fluids, and ability to develop suitable equipment, are the present limiting factors in metal-removal rates.

The size of particles removed at each arc discharge may be preselected by controlling the energy of the discharge, which is a product of three factors: volts, amperes and time. These three factors may be varied and the energy product maintained constant, or adjusted to raise or lower the energy product. An infinite number of combinations are possible.

Wide variations in cutting speeds, particle size, and tool erosion rate are obtained by varying the individual factors, even when the energy product is held constant. In addition, the "off" time of the cycle can be varied, with still further variation in results. In general, however, material-removal rates (in cu in. per min) that leave a commercial surface finish of about 60 mu-in. (as measured with a Profilometer) are about:

Zinc alloys, die cast—0.200

Steel and steel alloys, regardless of hardness—0.025

Nickel and nickel alloys, regardless of hardness—0.050

Tungsten carbides—0.004

Titanium carbides—0.020

Faster rates generally result in production of rougher surfaces; slower rates give better finishes.

These rates are not entirely indicative of the total volume of material that may be removed in a given time by one tool, as it is common practice when drilling to use a hollow tube as the electrode, and cut around the periphery of the tube, thus eliminating the cutting away of the center portion, as in trepanning. Multiple-element electrodes (built up like motor and generator commutators) which discharge simultaneously also are practical for upping cutting speed.

Surface finishes ranging from a semi-polish to unusable roughness may be obtained, the measure of roughness being generally somewhat indicative of the rate of metal removal, as in conventional machining operations employing bits that produce chips.

Where finish is important, fast rough cutting generally is used to remove the bulk of the material, then a slow finishing cut is taken to produce the desired finish and accuracy. Under carefully controlled conditions, accuracies in the order of those attained by lapping may be obtained, holding within 0.0002-in. tolerance or closer if sufficient time is permitted.

Electrode material generally depends upon the application. Commercially pure copper tubing has been used almost exclusively for some time for such operations as removal of broken tools and for hole drilling where close tolerances are not important.

Molybdenum tubing has been used for some applications where an electrode ground to size was necessary. With controlled energy discharge and space relationship held consistently between tool and work, thermal effect is minimized and the higher melting point of molybdenum is not too important. For most applications, differences in melting points between molybdenum and copper is not commensurate with the difference in price.

Brass and similar alloys possess both mechanical and electrical characteristics which make their use as electrode materials desirable for some types of work. They can be machined accurately and cheaply for making odd-shaped electrodes for precision operations.

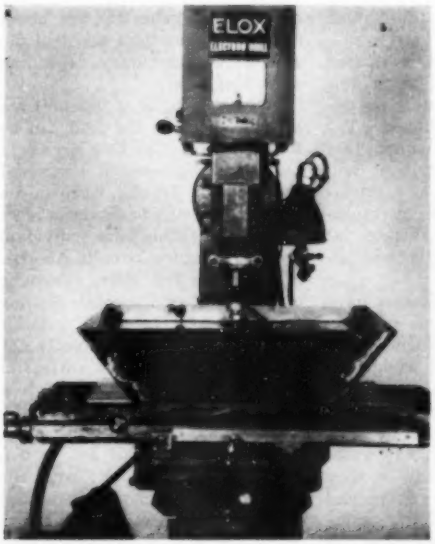
A suitable fluid (coolant) is necessary in arc machining. Water and soluble-oil compounds can be used for fast, relatively rough cutting operations, as in removing broken tools from workpieces. But for fine, precision-cutting operations, some form of hydrocarbon or other dielectric cooling medium which precludes electrolysis has been found to give better results.

Fluid pressure varies with the type of work, and ranges from 40 to 400 psi. Average pressure is about 120 psi. The fluid can be fed to the work in three ways: down through the hollow electrode, up from the bottom of the work through a predrilled hole, or in from the side through slip fittings.

Development of the arc-machining process as we know it today undoubtedly started as a result of noting the action of an electrical contact etcher or metal marker. The first machines built, in fact, used the etcher's ac circuit, and employed first an air blast and later liquids as gap media.

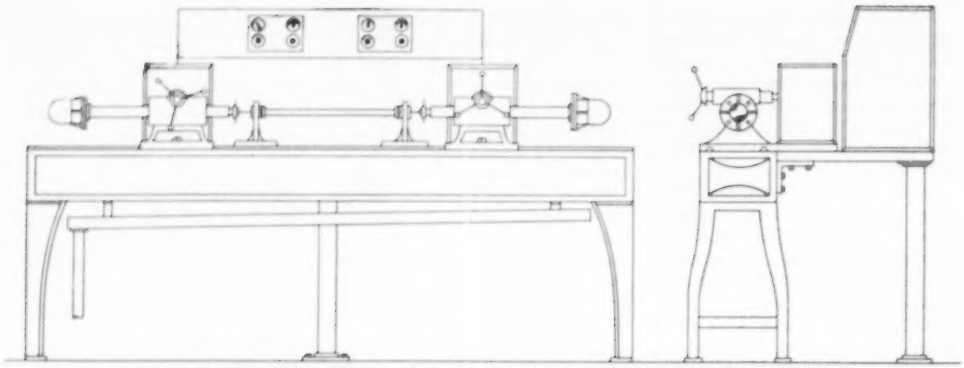
Such a tool was developed almost 10 years ago at the Propeller Division plant of Curtiss-Wright Corp. by Louis Waidler and Gus Holfelder. It is described in *Wings* for July, 1942. This tool employed a 110-volt, 60-cycle heavy-duty, Martindale electric etcher transformer as the power source and had an Elkonite tip on the copper tool tube. Air was forced down through this tube to blow away the particles expelled both from the workpiece and the tool tip by the electric arcs discharged between them.

This tool, like others developed soon after, was applied principally to the salvage of production parts



Drilling and tapping of sintered carbide and hardened tool steel tool and die parts is accomplished within precision tolerances with this recently introduced Model V-600 arc-machining unit. Workpieces are submerged in coolant when solid drills are used

Finishes of 2 to 4 mu-in. rms have been produced on surfaces of tungsten-carbide toolbits with this arc "grinding" setup on a Delta surface grinder. Brass ring replaces diamond wheel when cup wheel is desired, disk is used when peripheral "grinding" is preferred



Special double-end deep-hole arc drill was built to solve difficult production problem. It will drill 0.080-in.-dia holes 28 in. or more deep without runout. Separate power and control circuits are provided for each of the two heads

in which broken tool bits, drills, reamers or taps had become embedded. It is possible with a tool of this type to cut away the broken cutter without affecting in any way the surrounding workpiece material.

In the unit developed by Waidler and Holfelder, the tool was lowered slowly by hand as the core of the tap or other broken tool was burned away. In a commercial tool developed by Harding during June, 1943, the tool tube (generally copper or molybdenum) was lifted off the work by current flow through a solenoid formed by coiling the metal fluid-supply tube around the magnetic toolholder, causing an arc to discharge through the gap formed. This action was repetitive, as flow of current through the solenoid was interrupted as soon as the arc was broken and this let the tool drop into contact with the work again. Such tools still serve as an inexpensive and positive means for extracting the occasional broken drill or tap. But they remove metal slowly and are "temperamental" in use, while consuming large amounts of tool electrode.

One of these units was sold by Elox to the Russian Purchasing Commission in 1945, after the Commission had been supplied with complete descriptive literature early in 1944. This equipment and data, together with data obtained from other U.S. manufacturers, undoubtedly started the Russian development of the arc-machining process which has been reported in *American Machinist* (1947) and other technical publications.

Shortly after the introduction of this ac series-type unit, it was found by McKenzie that a polarized dc discharge over a predetermined gap through a liquid resulted in much faster cutting rates without excessive consumption of tool electrode. The improved action is explained by the theory that, with the tool maintained negative with respect to the work, electrons are discharged only by the tool.

Over a 5-yr period, a limited number of machines using this new principle were built while development work continued. The need of a servomechanism that would accurately position and maintain the electrode a predetermined distance above the rapidly receding work surface as cutting progressed soon became apparent.

A number of mechanisms have been developed for this purpose, and a few are in production. Essentially they must be capable of measuring and maintaining the discharge gap, and yet be able to approach the tool toward the work surface rapidly so as not to waste production time. In addition, they must be able to retract the tool rapidly in case of external influences. One such unit measures the average discharge voltage and translates this information into mechanical positioning of the electrode in relation with the work.

An improved dc unit (Model M-10) equipped with automatic feed was introduced early in 1950. It serves as a general-purpose high-speed salvage unit and will handle tubular electrode drills ranging from 0.040 to 5/16 in. OD and larger. Using 36-in.-long electrodes to minimize drill replacement, this unit will drill a 0.040-in. hole through 1 in. of hardened tool steel in 280 sec and will drill a 5/16-in. hole to the same depth in 600 sec (10 min). Holes drilled with units of this type generally are about 0.007 in. larger than the drill diameter, with accuracy depending on cutting rate.

Many variations of this unit are possible, because the drill can be fed in any direction. One already in use is a double-ended horizontal machine for drilling 0.080-in-dia and smaller holes to depths of more than 28 in. Heads have individual power and control circuits. Another is a hopper-fed fully automatic machine for simultaneously drilling two wire-lock holes in stainless steel aircraft nuts is currently under construction after successful tests on a prototype. This is a difficult machining operation by conventional methods because the holes are only 0.050 in. in dia, drill approach is 30°, and the material workhardens quickly. But these factors do not cause difficulty when using the arc-machining process.

For die and mold work in hardened steels and sintered carbides, the recently announced Model V-

600 precision drilling and tapping machine, essentially a vertical mill or jig borer with tapping attachment, is capable of working to very close tolerances in producing through holes and bottomed cavities of almost any required peripheral shape.

Basically the power supply used to create the electrical discharges for this unit is the same as that used for the Model M-10 unit. Modifications give better control of discharge current and time. A more precise form of servomechanism is employed to position the electrode relative to the workpiece.

Initial laboratory tests made with temporary setups on engine lathes and small surface grinders by Elox engineers have produced fine surfaces and sharp cutting edges on tungsten-carbide toolbits. To achieve really fine finishes, arc-finishing speeds were much slower in terms of rate of metal removal than those given above for finishes averaging 60 mu-in. rms. And the Russians have reported successful application of the arc process for this purpose. Field tests have not been made with tools sharpened by this process, so definite recommendations cannot be made now. Perhaps future tests will lead to suitable arc finishing of carbide tools to relieve current heavy requirement for diamond grinding wheels.

HOW TO DRILL TITANIUM ALLOYS

To answer recent requests from readers, we have put together here all available data on drilling, reaming and tapping the material, based on recent tests

DRILLING and tapping are major problems in machining titanium, judging from current inquiries. The difficulty arises from the tendency of the material to workharden and chip-weld, plus a tough, noncurling chip and poor thermal conductivity.

Lockheed reported some months ago (*AM*, Oct. 1, '51, p 179) that drilling must be continuous to prevent workhardening, and that pilot holes are inadvisable for the same reason. The initial recommendations were a drill with point off center, to drill an eccentric hole (thus minimizing rubbing, pickup and heating) and notched lips to break chips. High-cobalt drills seemed best. However, an eccentric drill produces a hole of varying diameter, and holes will vary one from the other as well.

Avey Drilling Machine (*AM*, Jan. 21, '52, p 314) used 12% Co HSS drills with 29° helix angle and 140° included point angle. Drills were as stubby as possible and the setup rigid. With highly sulfurized oil, cutting speed of 9 to 12 fpm, and feed of about 0.004 ipr on an 0.096-in.-dia drill, Avey got 20 to 25 holes 0.420 in. deep.

Greenfield Tap & Die Corporation has since made a number of additional experiments which clarify the problem. Drilling was done with a 17/64-in. drill to produce 65% depth of thread for a 5/16-18 tap. A fast-spiral drill worked best, with included point angle of 135-143°, 135° being preferable. For coolant, standard sulfur-base oils proved inferior to some water-soluble oils and particularly to Thred Kut 99 as well as to CO_2. At 450 rpm (31 sfpm) and 0.006 ipr, 20 to 90 in. could be drilled between grinds. This is three times the surface speed of the Avey tests, and twice to nine times the work between grinds.

Greenfield tests also indicate that with CO_2 as the coolant, there is no cold-working of the material as long as the drill stays sharp, but immediate cold-working when it dulls. Dulling can be detected quickly from the squealing, just as in drilling other materials susceptible to workhardening. If workhardening occurs, tapping becomes almost impossible.

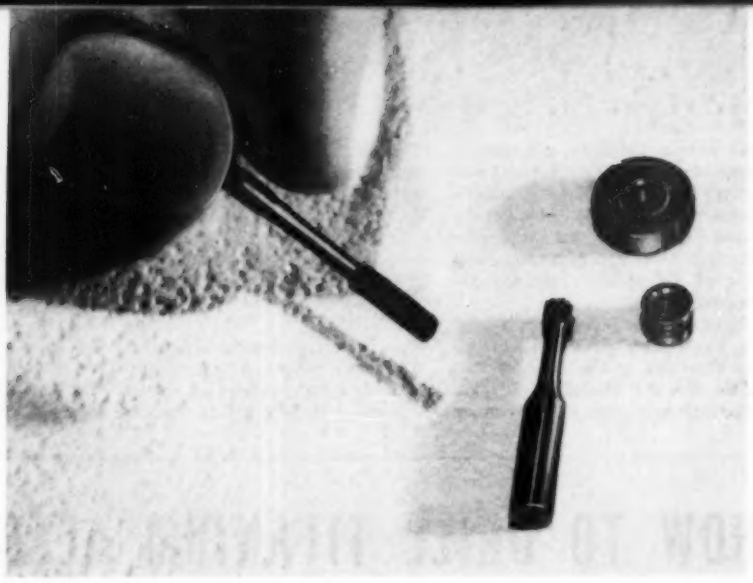
Another company, making extensive tests both on forged and on machined titanium 150A, reports results almost identical with those at Greenfield, except that CO_2 was not tried.

Chance-Vought reports titanium drills somewhat like quarter-hard stainless but requires a lower drilling speed and constant feed to reduce or avoid cold-working and wear of the cutting edge. Engineers there emphasize, as Avey does, that drills should be as short as possible; a long, flexible drill drills an out-of-round hole. They also point out that feed should be reduced as the drill breaks through, to avoid heavy burrs. Tests there gave 100 to 150 holes per grind.

Whitman & Barnes found that 136° included angle resulted in least burr, but that 90° included angle resulted in best roundness. Tests there were run in a drill-press with water-soluble oil as the coolant. Speeds up to 75 fpm were satisfactory.

Titanium could be reamed successfully, under general conditions, with either straight- or spiral-flute reamers. Holes reamed in a drill-press were suitable for size, roundness, and finish. With a hand drill, at normal speeds (1750 rpm), reamers with conventional chamfer angles cause excessive chatter. A taper reamer, or a regular reamer with a longer lead angle, avoids the chatter.

Only reports on tapping come from Lockheed. Interrupted-tooth taps worked best. Speeds of 12 to 15 fpm proved satisfactory for a 60% thread.



"LITTLE MONSTER" . . . Difficulties of finishing the 0.09375 in. bore for the inner race of the R 1.5 ball bearings have earned the part this name by shopmen. It is SAE 52100 steel heat-treated to R.63, or stainless AISI 440C, must meet very exact tolerances. First used was the pencil wheel at left; now the bur beside the race is being substituted

CARBIDE BUR AT *90,000* rpm FINISHES

BY E. J. TANGERMAN, EXECUTIVE EDITOR

Early in 1951, demand for small precision bearings rose to major production quantities. One bearing in particular, was vitally needed in guided missiles, and in other electronic control units. Designated the R 1.5, the bearing has 5/16-in. OD, is 0.109 in. wide, and has 0.09375-in. bore. Race materials are SAE 52100 high-chrome bearing steel or AISI 440 C stainless.

To hold the bearing within tolerances, +0.0000, −0.0002 in. on the OD and 0.0002 in. max. eccentricity (total indicator reading) requires precise finishing after hardening. This means grinding of the bore of the inner ring to 0.09375 (+0.0000, −0.0002 in.), because the inner ring, in the case of 52100 steel, averages R.63. Stock removal is 0.003 to 0.004 in., finish must be 4 to 6 mu-in. profilometer, taper less than 0.0001 in., and roundness within 0.0001 in.

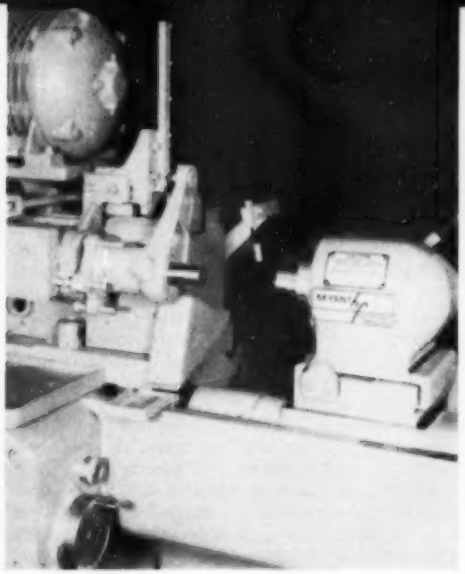
The original bore-finishing method was grinding at 90,000 rpm with an 0.085-in. pencil wheel by standard procedure in an internal grinder. Both The Barden Corporation, Danbury, Conn., and New Hampshire Ball Bearings, Inc., Peterborough, N. H., used a slide-feed unit with a Bryant high-frequency head traversed during grinding. Because of small diameters (about 0.085 in.) wheel wear was excessive; one wheel would finish only 10 or 12 pieces. Wheel breakdown also made it impossible to produce the required finish.

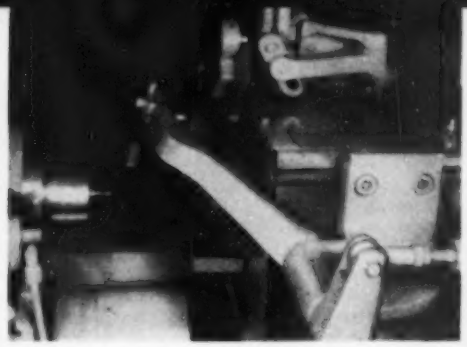
A shift to diamond-impregnated quills, and another to "diamond-plated" quills raised production to 30 or 40 parts per wheel, but they were not uniform for size, geometry, or finish. Real production looked hopeless.

At this point, Stewart Howe of Barden mentioned the difficulty to George Eglinton, then with Lincoln Park Industries, Detroit. Mr. Eglinton, an expert in the use of carbides, suggested carbide burs, expressing the opinion that, if carbide burs failed, the problem was practically unsolvable. Mr. Howe took the suggestion in turn to the Kellerflex Dept of Pratt & Whitney, W. Hartford, Conn., and to Bryant Chucking Grinder Company, Springfield, Vt. Both were dubious of success because of repeated failures with earlier attempts through the years. It was recalled, however, that better carbides are now available, plus greater uniformity in hardness and better control of bur geometry. Also, carbide burs are being used successfully for die grinding and other less-precise boring and finishing jobs. But knowledge of proper speeds for each material, and suitable close-tolerance bur-grinding equipment were both lacking.

Pratt & Whitney agreed to provide a selection of carbide burs, and Bryant to undertake a series of tests. Burs ranged from oval and barrel shapes to cylindrical, with straight, right- and left-hand helical, and Di-Bur flutes, varied numbers of teeth, and in various carbide grades. Extensive tests resulted in selection of a straight cylindrical bur 0.083 in. dia, with right-hand helical flutes and standard grind.

A new "grinding" procedure or technique was also developed. The 90,000 rpm (about 2000 fpm) was retained after tests at speeds from 60,000 to 150,000 rpm. Instead of rapid traverse of the wheelhead, traverse was slowed to about 2 ipm. Instead of a single pass, the bur





CLOSEUP . . . This view, from the back side, shows the diamond stick for dressing after each two passes, also the feeder arm and hopper (center). Wheelhead is at left

TOOLING . . . A high-frequency (90,000-rpm) wheelhead at right carries the carbide bur. Inner races are taken from the vertical slide at center by the pickoff arm shown in removal position. The arm deposits the piece in the diaphragm chuck in the housing below. Upon completion, the piece is ejected into the hopper. Handwheel at bottom feeds workhead across

EXACT R_C63 BORES

Hardened inner races for ball bearings "ground" to 4-6 mu-in. surface and less than 50 millionths out-of-roundness

made two passes. Machine crossfeed was not moved during bur traverse, but was positioned before the cut. (Actually, the operator adjusts crossfeed only about every 50 pieces, the holes in the interim walking down through the tolerance at a uniform rate.) Instead of standard cutting fluids, a blast of dry air is directed through the diaphragm chuck, serving also to eject the part at the end of the cycle and to blow away chips. Cycle, on this basis, was 24 sec, of which 6 sec is loading time.

Tests indicated that the outer diameter of the bur wears very slowly. Cutting is apparently done only by the leading edges of the lands, the action being similar to that of an end mill. Thus the bur could be dressed with a small diamond stick passed lightly over the end, and required only the infrequent adjustment for side wear mentioned above.

Tests have shown that burs can produce as many as 50 pieces on one manual dressing, and that bur life runs as high as 2000 pieces of 52100, and—in one case—to 5000 pieces of stainless. But, in such cases, the familiar problems of size and finish tolerances recur. Normal production appears to be about 250 pieces of 52100 per bur, with the bur dressed automatically after each two passes (one complete cycle). In automatic production, pieces under these conditions are finished to 4-6 mu-in. rms, size is within tolerances, and roundness is held within 50 millionths inch.

Production installations have now been made at both Barden and New Hampshire Ball Bearings, each being made on a new Bryant 2209 D automatic internal grinder with mechanical camming and two electric brakes on the cam drive. Parts are fed by the operator into a vertical magazine, from which they are taken singly by an expanding mandrel on an arm that swings down to place the piece in a diaphragm chuck. The bur, in a 90,000-rpm, high-frequency wheelhead, makes two passes, and is dressed by a diamond stick on a vertically swinging arm. The air blast then ejects the piece into a hopper ending in a chute.

The bur, 0.083 in. in diameter, is only 11/16 in. long, with shank ⅛ in. in diameter and flutes 1/16 in. long. Concentricity is held to 0.0005 in. max., and cutting sides are held parallel within 0.0002 in. This required development of special bur grinders, so Pratt & Whitney has announced a line of hole-grinding burs from 0.083 in. to ½ in. in diameter—with the provision that each job be engineered.

All this does not mean that this particular problem is entirely licked. Results are very encouraging, but there are still difficulties. Further, there are indications that piece tolerances must be held to very close limits on this tiny hole (they are less important as hole size goes up). The burs can readily remove 0.002 or 0.003 in. of stock, but the amount must be consistent; swings of several thousandths in stock removal cause variations in finish and hole size, particularly in SAE 52100.

Barden engineers are also working on the premise that bur life is short and scrap is high if race hardness (in SAE 52100) varies more than one point R_c. If a harder piece (say R_c65) is struck in a lot that

is R-63, the bur will be spoiled. If the odd piece is much softer, this permits the bur to cut too fast, resulting in an oversize hole. The problems of hardness are multiplied by the fact that an out-of-hardness piece causes variations that create poor finish and minor irregularities in some of the pieces that follow, even though they may be entirely correct. To avoid trouble, infeed must be adjusted to piece hardness, manifestly impractical if each piece is to vary much from those ahead and behind.

Tests are now in progress on this, because it would require small-batch heat-treating work to a hardness of say R.63-64 instead of the usual somewhat wider range.

Another problem is the chamfer at the bore ends. Chamfering is done in the screw machine before hardening, of course, and creates a fairly heavy burr as the chamfering tool begins to dull. Barden engineers feel that this may damage the tool or cause irregularity, but New Hampshire Ball Bearing engineers believe that the bur itself is the key to success or failure.

Other Sizes, Too

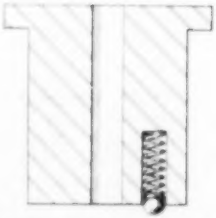
R. H. Cherwin, vice-president in charge of production of New Hampshire Ball Bearings, says: "We have been using both a Bryant 2209D automatic and a Bryant 1109 semi-automatic with these burs and getting good results on both. We have finished holes 0.055 to 0.218 in. in dia, but results below 0.093 in. dia have been too erratic to permit us to put the machines in a production run.

"We also find that three passes of the bur will give better size control, even though it slows the grinding cycle. It is my opinion that the key to the success of this operation is almost entirely in the bur. This is more or less proved by our last lot of burs, which have given us very consistent size and wear.

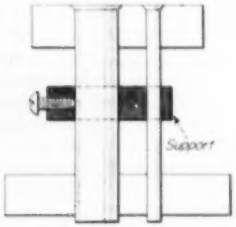
"I believe there is a great future for this application in small-hole finishing, but there is also a great deal of research still to be done before it is perfected. We are now doing considerable work on this problem and hope to have some definite results before too long."

DIEMAKERS KINKS

BY FEDERICO STRASSER

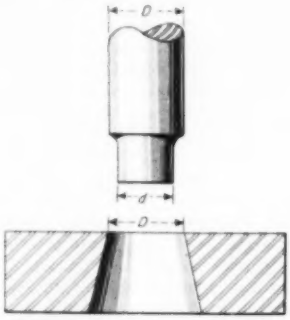


IF BLANKS STICK to the punch face, drill a small hole for a helical spring and steel ball. Prick punch or stake around the edge of the hole to retain the ball. This shedder design takes little space, and very often is convenient when the center of a comparatively small punch is occupied by a pilot.

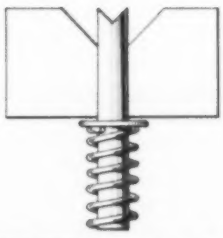


SMALL PIERCING PUNCHES are easily bent or broken. To prevent damage as far as possible, apply a support midway between punch plate and stripper and fastened to an adjacent sturdy punch.

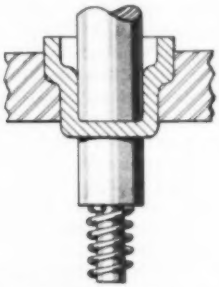
AN AUTOMATIC EJECTOR on second operation piercing dies saves time. The workpiece is located in a full-outline nest. After piercing, the workpiece clings to the punch, is lifted out of the nest, and bears against the inclined plane of the ejector, is that the latter is pushed leftward. As the workpiece is stripped from the punch, the ejector snaps it out of the die.



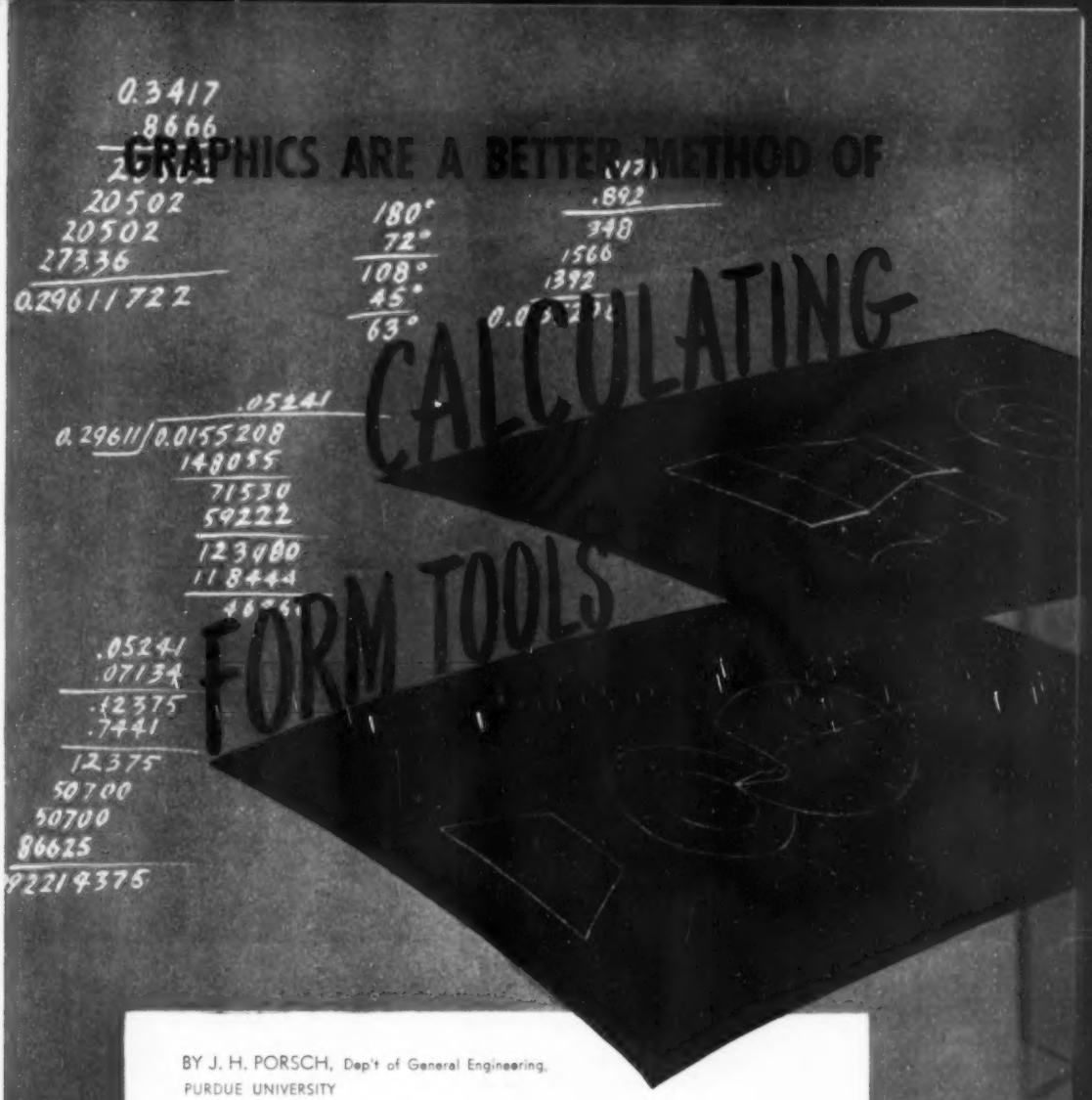
ALIGNMENT of punch and die opening may be obtained quickly by the following method when a die set is not used: Make the punch of the shouldered variety, as shown. The punch body has the same diameter as the die opening. By lowering the press ram so that the punch body enters the die opening, alignment is automatically obtained and the clearance is uniformly distributed.



GRIPPER PINS are recommended for bending dies to prevent the blank from slipping sideways during the bending operation, and creating a part with unequal legs. These gripper pins also act as an ejector.



DIFFICULT REDRAWING operations can be made easier, sometimes, by maintaining pressure at the bottom of the shell, instead of on the side walls by a hold down



GRAPHICS ARE A BETTER METHOD OF CALCULATING FORM TOOLS

BY J. H. PORSCH, Dep't of General Engineering,
PURDUE UNIVERSITY

Finding the true shapes of form tools for turning, corrected for rake, clearance, and vise angles, is a difficult and tedious job by the mathematical approach. The graphic method is often considered inadequate because it supposedly requires a skilled engineer and scaled-up drawings; but most form tools are small, and tolerances are reasonable. Therefore, some care in layout can result in quick, simple solutions to tough tool-design problems—with less chance of error

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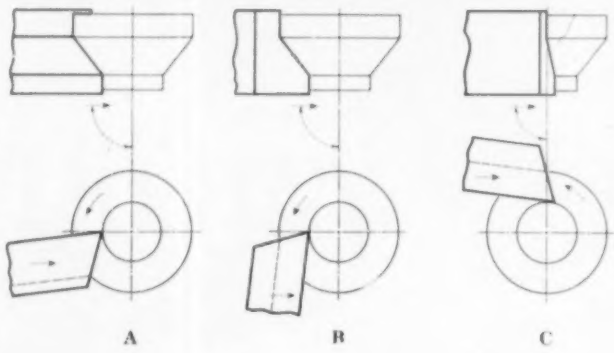


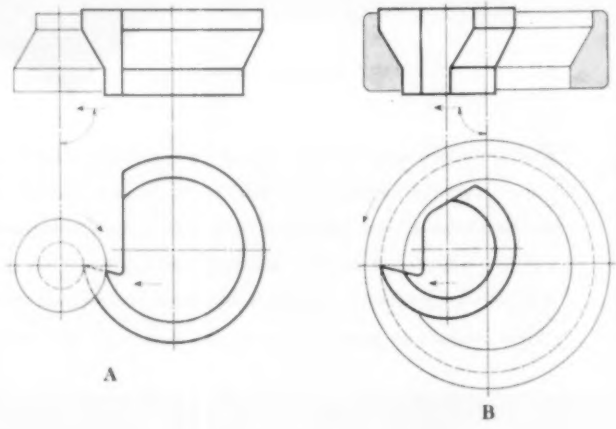
Straight forming tools that feed directly into the work (A and B) are simplest to calculate and make. Tangential feeding (skiving) gives better finish (C)

1

The man-size job of calculating forming tools has three general solutions: mathematics, graphics, and cut-and-try. The third of these methods, cut-and-try, is a toolmaker's system and may or may not work out accurately, depending on luck as well as skill. The main trouble with it is that it may be a large time-waster.

Calculation of forming edges is probably the most accurate method, fundamentally, but it is also often inefficient. The engineer's slide rule is out of the question because of accuracy requirements, and a calculating machine is almost necessary. The method is also slow and tedious, subject to normal human errors, and not easily checked by any rapid method.

The remaining method—graphics—has its limitations, too. For tools that must be unusually accurate, it will probably not work. The system does require an engineer who has his wits about him, and understands solid shapes and fundamentals of projection; but with these conditions fulfilled, the method is fast and easily checked. The engineer can use tools—drafting instruments—with which he is most familiar, and he does not have to be a mathematical wizard.



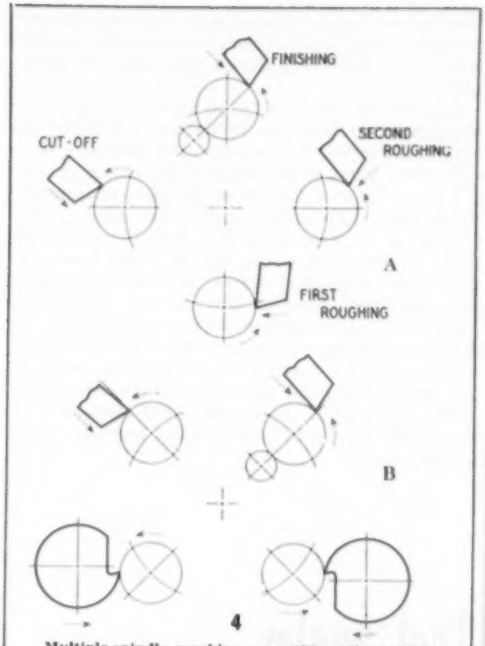
Circular form tools are ground easier and replaced in setup with less adjustment than straight tools. For ID work (B), positioning is slower because they must be fed into hole, then out to touch work

2

Forming-tool angles

Angles on straight and circular form tools are similar; the most outstanding difference being that the circular tool has no clearance angle. This is taken care of by the natural OD curve of the tool, and by its location next to the work. If the tool centerline is above that of the work and the cutting edge is ground down to the level of the work centerline, clearance will automatically be provided. Other angles are much the same on the two kinds of tools, and they are calculated or constructed by similar methods.

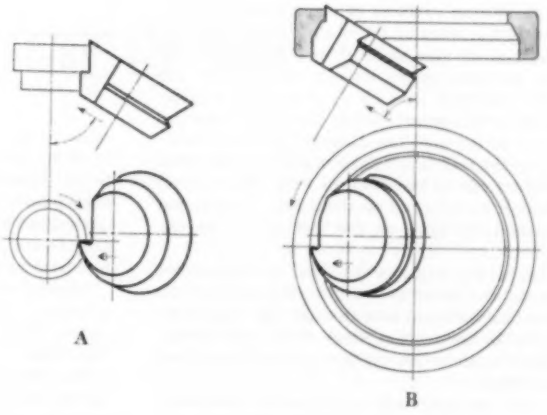
Feeding methods, however, vary. Circular tools can be fed straight into the work, or at an angle, because their tips never pass the smallest OD (or largest ID on internal cuts) of the work. Angular feeding is often done because a tool can cut a path wider



4

Multiple-spindle machine can utilize all straight (A), all circular, or combinations (B) of circular and straight tools. Improved setup has circular tools doing heavy work, skiving straight tool doing finishing

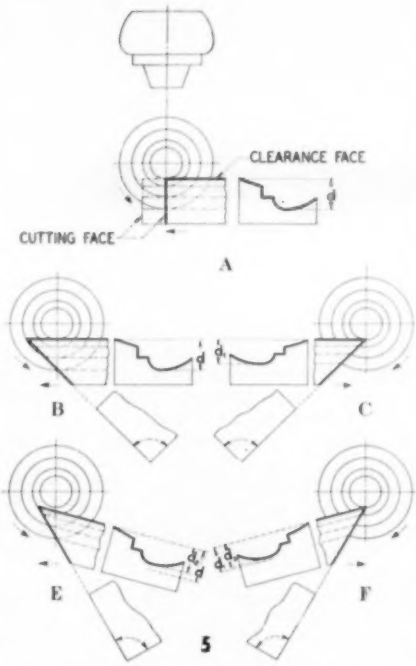
Angled tools can cut wider forms than same tools at 90° to work face. Cutting load is spread more evenly over tool edge when cutting corners and shoulders, though depth stops must be more accurate



3

than its own cross-sectional width this way. It can also get behind shoulders and can turn and face at the same time, which may reduce operations considerably.

Straight tools are usually fed into the work at an angle of 90° to the work centerline. In skiving, or tangential feeding, this is most often necessary because the cutting edge may pass the center of the work, and the tool form must therefore correspond to the shape of the work so it will clear. Skiving can be done at an angle, sometimes, if an extra-smooth finish is desired. However, the work must have a form made of gradual curves, not sharp shoulders or necks. Where the tool does not skive, feeding is generally done straight-on because of convenience. If angular feeding is required, calculations or constructions to find the shape of the required tool are just more complicated applications of the same principles that convert the desired work shape into a form tool; for that is what the tool engineer must accomplish.



Depth of form varies as clearance and rake angles change: **A**—full depth with no rake or clearance, **B**—positive rake but still full depth because clearance angle is still zero, **C**—no clearance, but reduced because tool passes center, **E** and **F**—reduced depth because there are positive clearance angles

Tool angles

Two surfaces make a tool's cutting edge where they meet; and the angles, shapes, location, and motion of these surfaces control cutting action of the tool (see Fig. 5).

Considering straight forming tools as representative of all types, the simplest tool is a formed skiving block with cutting surfaces at right angles to each other and to the sides of the block . . . no rake, no clearance, and no vise angle. The formed shape of the block, in cross-section, must be the same as the work. The tool must pass up to or through a plane through the work centerline that is parallel with the cutting face of the tool. The distance from the clearance face of the tool to the deepest point on the form must be the same as the distance from the smallest to the largest OD desired on the work. That is, the form depth is the same on the tool as it is on the work.

Grinding a rake angle on the front of the tool has no effect on the other tool angles, but the tool tip must pass this vertical plane through the work centerline, or else the deepest edges of the tool (which are back of the tip because of the rake angle) will not cut to full depth.

Now, with the same rake angle and no clearance, it is possible to advance the tool only to touch the plane through the work centerline; but in this case the tool form must be made shallower in proportion to the original tool. This foreshortening is essential to make the deepest ponts on the cutting edges cut to full depth when the tool stops—which leaves these deep points in front of the plane through the work centerline. They must get closer to the work because they do not advance as far as the same points on the tool with no rake or clearance.

Tipping the tool to produce a clearance angle has a similar effect. The form depth is foreshortened again, all in proportion to the true shape desired on the work.

The shapes of these foreshortened cutting faces can be found by passing cutting planes through the work where the tool will stop or where it will reach full depth, if it is not to stop. This construction is a matter of simple projection.

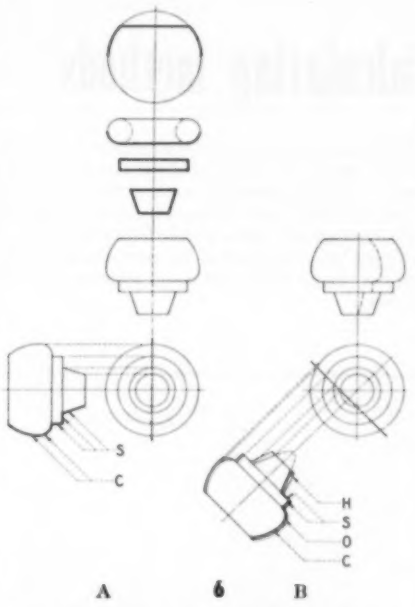
Cutting planes

With the introduction of these shallowing effects, the shape of the cutting edge is altered. A plane through the work centerline would cut parts of straight lines and circles if the work were as shown in Fig. 6.

But a plane through the work, parallel to the centerline, not through it, would cut parts of hyperbolas and ovals, in addition to straight and circular lines.

Once the cutting plane has been established on the layout of the workpiece, the tool can be calculated. Assume the tool for the same piece of work (Fig. 7) is to have rake and clearance, and is to stop with its tip at the vertical plane through the work centerline. First the cutting plane is established, then the clearance plane is located. These lines are located where the tool will be as it cuts full depth.

The form tool is to be reground a number of times, so the form is carried back from the cutting plane. This form can now be projected to show a cross-section of the tool, as cut by a plane at right angles to the form itself (A).



Form analysis breaks down work shape into segments. Plane through work axis (left) cuts simple shapes: S—straight lines, and C—parts of circles. Plane parallel to axis cuts these plus more complicated shapes: H—part of a hyperbola, and O—part of an oval

Making the tools

Finding the tool shape for a given product is one thing, but making the tool to fit the work is another. Hyperbolic and elliptical surfaces are not easy to produce; in fact, they were only recently made possible to high accuracy when comparators and highly sensitive tracing machines were developed. Producing the original form, with its series of straight and curved lines, is still difficult.

One dodge is an old one to experienced toolmakers. This is to convert shallow curves into straight lines or parts of large circles, if the product design will allow such fudging. For example: The product shown at Fig. 7-A . . .

The truncated cone at the front end of the workpiece, when projected to the tool outline, comes up as a section of hyperbola (H). This can be converted to a straight line, but the tool will then dish the work.

To get away from this undercutting, the tool can be designed with a compound rake angle. This produces a straight line on the tool to cut the cone sector, but the curve farther along the tool edge that was an oval (O) in A becomes a curve that is almost impossible to define. Further, other sectors that were fairly simple lines become more complicated, like the new ellipse (E) just under the indeterminant curve (X).

To further simplify the tool lines 1, 2, and 3 (B) can be made straight or circular, but accuracy of both tool and product suffer.

Calculating methods

Concerning mathematical approaches to form-tool design: Many are formulated for specific tool positions or certain products and are therefore limited in scope. Tables and nomograms that provide conversion figures for given problems are available, too, but they are also limited in application, although they may be perfectly useful and accurate for specific cases.

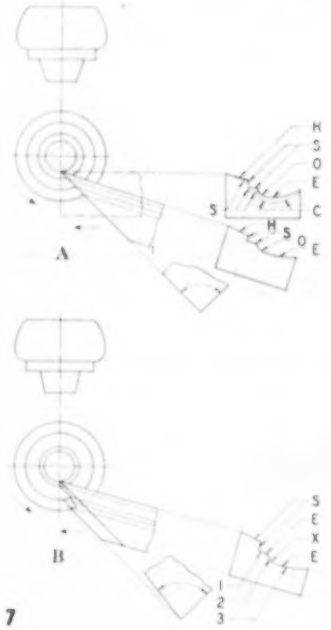
In many cases, mathematical tables or equations are so difficult to work with that many experienced engineers who are not currently up on these form-tool methods are in trouble. Working with four decimal places to insure accuracy to three places is objectionable, both from the point of view of excess labor and time necessary, and from the strong probability of arithmetical errors. These undesirable features can be eliminated or reduced by the graphic approach.

For the designer, who is usually an experienced draftsman, these advantages are apparent:

1. Drafting table and tools are at hand and are convenient.

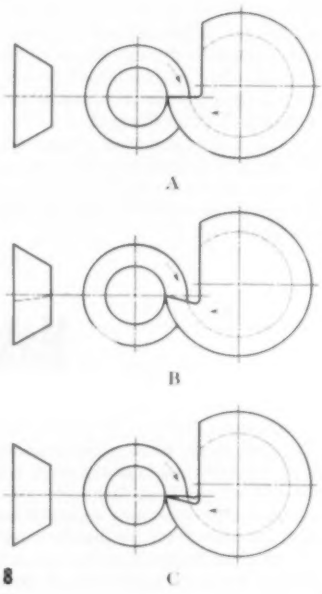
2. The designer is familiar with a system of projection that is comparable, in end result, to mathematics; but with which he is probably more versatile. He can normally see the tool in complex positions or views as well as simple ones, so the method is less limited than mathematics would be.

3. The designer can check his drafting results



7

Tool shape is developed from work segments. Tool with no rake or clearance (dashed lines—A) cuts same outline as work, but tool that goes only to center and has rake develops hyperbola, oval, and ellipse (E). Addition of clearance foreshortens these shapes. Compound angle (B) dishes tool and produces even more distortion. Sector X is not even a known or identifiable curve



8

Circular tools with zero (A), positive (B), and compound (C) rake angles are set with centers above center of work, providing clearance. Cutting edges are at or below work center. Tool edges must be developed from work shape, as affected by tool angles, just like straight tools

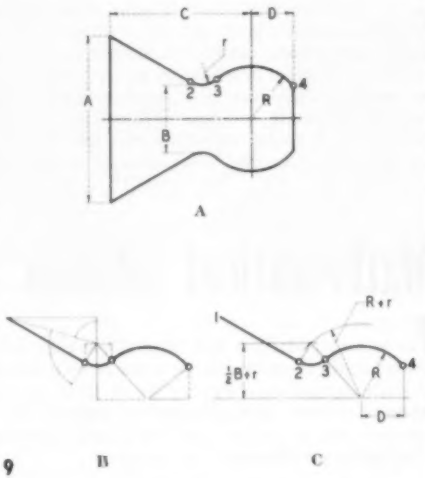
visually, which he cannot do easily with mathematics, even if he is expert.

4. Dimensions can be directly scaled, giving direct answers, instead of calculated from triangles, equations, and arithmetic.

5. Operations are reduced in number and complexity, resulting in fewer chances for mistakes.

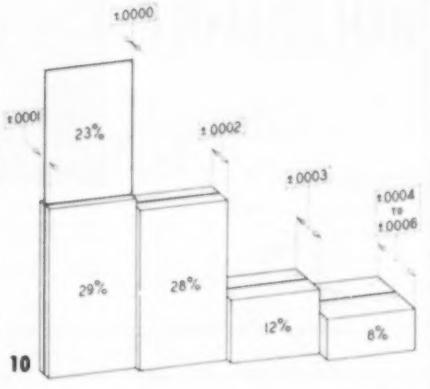
6. Substitution of approximate curves, where allowed, can be done much faster and without laborious recalculations and checks. Checking such curves is easy, too.

7. Time consumed is much less.



9

Comparison of graphic vs mathematical solutions of form shows relative simplicity of graphic system. Mathematics require solutions of various angles and triangles more (B); graphic needs only center location (C)



10

Comparison of graphic vs mathematical results shows little deviation. Forms for 200 tools were first solved by graphics, then checked by mathematics. All results were well within normal 0.0005-in. tolerances

Graphic solutions

For a simple two-dimensional problem, much of the work has actually already been done by the product designer. Fig. 9-A shows a simple product, which is analyzed graphically at C and mathematically at B. By trigonometric means, nine sides and triangles or angles must be found, in addition to the easy additions involved. The problem is not difficult, but is time-consuming.

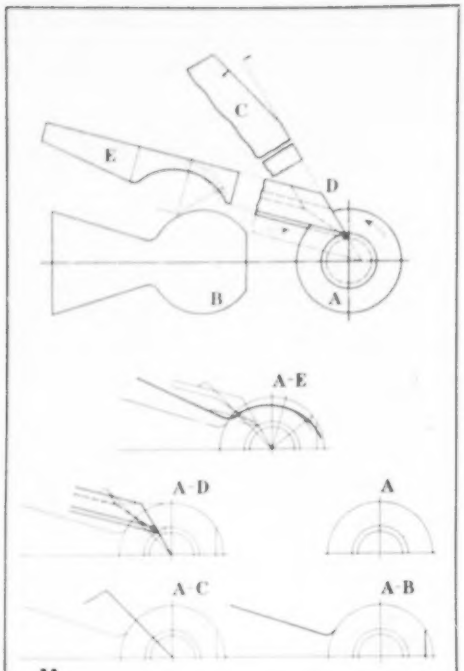
The graphical solution is solved by finding point 4 from radius R and length D. The center of the small arc is the intersection of ½B + r and R + r. The straight line is found from part dimensions and by drawing it tangent to the small arc. The advantages in this case are apparent.

The question of accuracy arises. Obviously, tools so large that scaled-up drawings would be of ridiculous size cannot be solved unless scaling up is not necessary. But scaling up is usually required to provide enough accuracy for most work. The only answer to accuracy is to try the system out, scaling up as much as reasonably possible, and comparing accuracy with other methods.

More than two hundred tools were designed over a period of some months. Each was worked out first with graphics, then checked with mathematics. The closeness of results was amazing (Fig. 10). The bar chart was constructed to show how a quarter of the tools were designed with no deviation of graphic results from mathematical. Half deviated no more than over or under 0.0001 in., and only two deviations were as much as 0.0006 in. The relative unimportance of those two deviations did not warrant a checkback.

Such results as these indicate that 0.0005-in. tolerances can be easily met with graphics.

Tools for the graphic method were a parallel straightedge, triangles, engineer's scale, magnify-



11

Skiving tool with vise angle is developed from views of work (A and B) and tool (C, D, and E). Actually, views are superimposed on each other (A through A-E, below) to reduce space needed to allow large scale, and to reduce construction errors. View A-B is a combination of views A and B, A-C is A, B, and C, etc.

ing glass, beam compass, and sharp pencil. Unquestionably, tools must be used with care to get the best of results.

When constructing the different views of the layout, some inaccuracies result when projecting is done. To limit this, it is possible to keep views of the same tool close together; in fact, it is often practical to construct one on top of another, allowing one pencil line to act for more than one view, and allowing the total area of the drawing to be kept down to permit a large scale.

This is illustrated in Fig. 11, where a skiving tool was laid out. This was to turn a curved part by feeding past the plane vertically through the work center. The tool had rake and clearance angles, and also a vise angle, which compounded the rake angle. This was to improve the finish of the work.

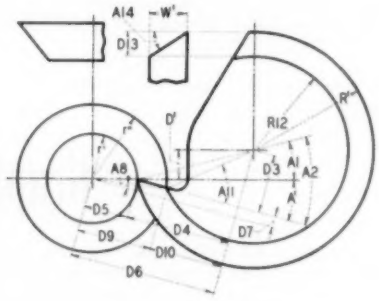
As normally laid out (above), the drawing covered considerable area. But condensed into a single concentric drawing, the layout was developed as in A, AB, AC, AD, and AE to show all the views above in a much smaller area. The same circles serve both views, which might not be possible for other cases; but the centerlines are common, which would always be possible, and which improves accuracy and simplicity.

This job took 1¾ hr, and was checked mathematically, by use of an electric calculating machine, in 8 hr. Some parts of the calculation were more difficult mathematically than graphically, but most of the extra time was the result of calculating through identical processes for similar or overlapping dimensions. The graphic method eliminated this trouble.

One thing about graphics: It is almost impossible to misplace a decimal point. Another point is that one error usually indicates misreading the scale, while more than one shows a wrong construction—all of which simplifies the finding of errors when they crop up.

Mathematical solution

For a simple circular tool with single rake and a center above the center of the work (for clearance), the calculations are shown in Fig. 12. This tool produces a conical workpiece with a slightly dished contour. For a perfect cone, of course, additional calculating and planning are required.



D' = R' × TAN A1	D4 + D5 = D6	D6 − D9 = D10
A' = A1 + A2	r' × SIN A' = D7	D3 + D10 × TAN A11
R' × SIN A2 = D3	D7 ÷ r' = SIN A8	D10 ÷ COS A11 = R12
R' × COS A2 = D4	r' × COS A8 = D9	R' − R12 = D13
r' × COS A' = D5		D13 + W' = A14

12

Circular tool with top rake, to cut cone product, is calculated. If tool edge is straight, work will be slightly dished; and if this is not allowable, tool can be given compound rake angle, increasing amount of calculation

While plant displays of quality-control achievements were set up for viewing by Harvester executives, they were checked by J. W. Armour, manager, and A. C. Richmond, of the Manufacturing Research Dept., for possible use in Harvester's booth at the Tool Show

STATISTICAL CONTROLS SAVE IH $10 MILLION

BY M. J. GRAHAM
Director of Manufacturing
INTERNATIONAL HARVESTER COMPANY

spoiled work and rework costs slashed in International Harvester plants by 4-year program, which also has improved product quality, production rates and methods, and has cut factory unit costs

Reductions in rework and scrap-cost ratios at the various plants of the International Harvester Company during the past four years represent a cost improvement totalling in excess of $10,000,000. These reductions have helped the company to maintain reasonably low selling prices for its products, despite rapidly rising material and labor costs. And Harvester management believes the practical application of statistical-quality-control procedures has been a major contributing factor in this worthwhile achievement.

During the four years that careful attention has been paid to the installation and maintenance of statistical-control procedures in Harvester's many plants, there has been a 31.6% improvement in the spoiled-work (scrap) ratio to prime (direct) labor cost, and the rework ratio has been improved 11.7%.

While these improvements have been in the making, inspection cost ratio to direct labor cost has risen only 0.2% despite the fact that all costs incident to the statistical control program have been absorbed in the inspection cost totals.

Quality of product has been improved materially, many hundreds of manufacturing operations have been made more efficient, production rates have been increased, and factory unit costs have been reduced through activities initiated by studies conducted by quality-control engineers.

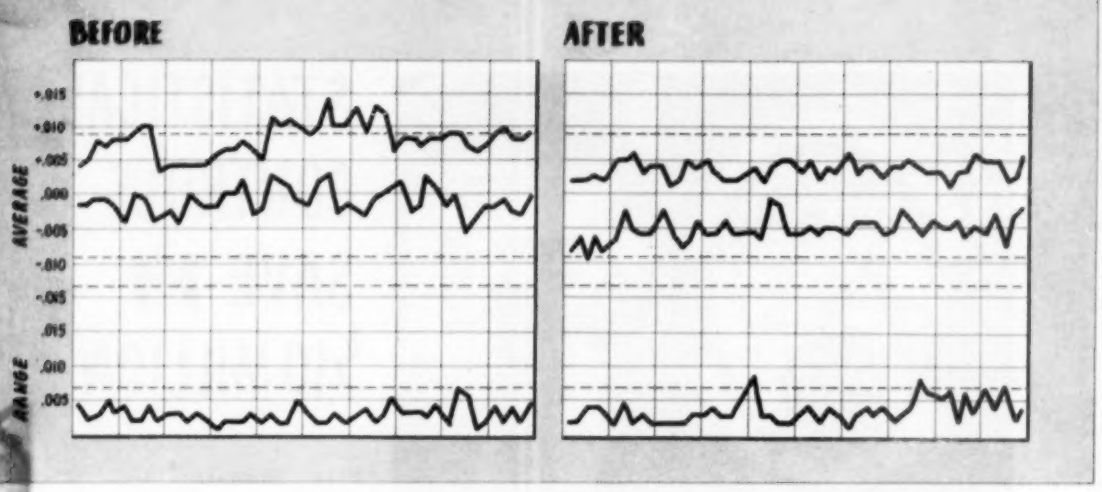
But these results could not have been accomplished had the men involved considered statistical quality control as just another inspection tool. Charts alone cannot improve product quality or operation performance. They can only point to the places where corrective action should be taken.

Credit for accomplishments made possible by statistical quality control must in most cases be given to the plant managers, production and tool engineers, and production supervisors who take action to correct conditions brought to light by the work of the quality control engineer. His job is to wave a warning flag when something starts to go wrong with an operation; other members of the production team must be responsible for bringing an operation back into control once a chart indicates it has started to stray.

For this reason, many Harvester plants have set up what are called "quality-control action committees" — teams composed of key men in the plant who can get things done when something goes wrong.

All of these points were emphasized time and again by displays shown by the 21 participating Harvester plants in a quality control exhibit set up recently at the company's Manufacturing Research Dept. plant in Chicago by A. C. Richmond, general supervisor of inspection methods research.

Developed originally by the vari-



Of outstanding interest in these days of **steel shortages** was Wisconsin Steel's demonstration of increased production made possible by statistical control methods. Without changing mill practices, except to hold rolling tolerances about the mean dimension (chart at right) instead of on the high side (chart at left), last year hot-rolled shapes equivalent to 117,000 additional rods 1 3/16-in. dia and 12-ft long have been made available to metalworking plants without adding to ingot tonnage per bundle. In 1949, a 6,500-lb bundle of 1 3/16-in. dia rods would have contained 143 12-ft bars weighing about 3.7872-lb per ft. By rolling to a mean dia of 1.1867-in. (instead of to an average of 1.1909-in. dia) the bars weigh 3.7605-lb per ft and the customer receives one extra bar per bundle. This is in effect a net gain of 2,600 tons of steel that did not have to be cut from bars and returned as chips

ous plants when asked to contribute material which might be used in the Harvester quality control exhibit planned for the ASTE Industrial Exposition, the individual displays were assembled in a central location for study. Combined, they painted so dramatic a picture of what statistical controls have meant to the Harvester organization that it was decided to make additional use of them. So company executives and supervisors were invited to view these displays in advance of the ASTE showing—and more than 300 of them had studied it before it was dismantled.

Each display unit told an impressive story of quality improvement, cost reduction, and improvement in operating efficiency. Collectively, they showed that statistical control procedures have equally important application possibilities in steel mills, foundries, twine mills, truck assembly lines, repair parts depots, heat-treating and plating departments, and shipping departments, as they have in machine shops. A few of the individual stories told by the displays are shown herewith.

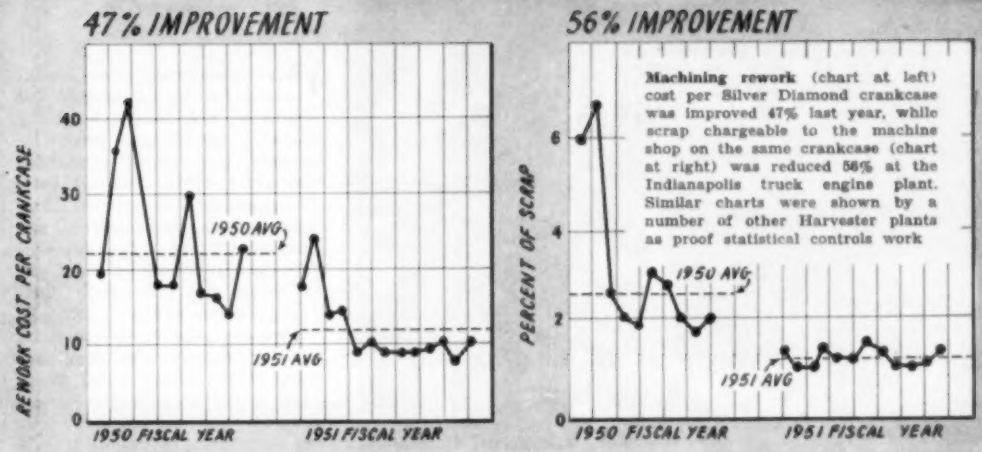
Not shown are such impressive accomplishments as the large reduction in foundry scrap losses accomplished at Harvester's truck engine foundry at Indianapolis last year by introducing and maintaining control charts on the hardness of cope and drag members of molds for crankcase castings.

Also not illustrated is the saving of more than $30,000 annually in hob cost alone made possible by applying statistical-analysis procedures to a study of high hob wear rates on one gear-cutting operation. The studies made on this job in the Louisville Works resulted in improved hob sharpening procedures, and in the development of inspection devices and methods which make it possible to determine how much should be ground off a hob to resharpen it, and then to check on the amount actually removed.

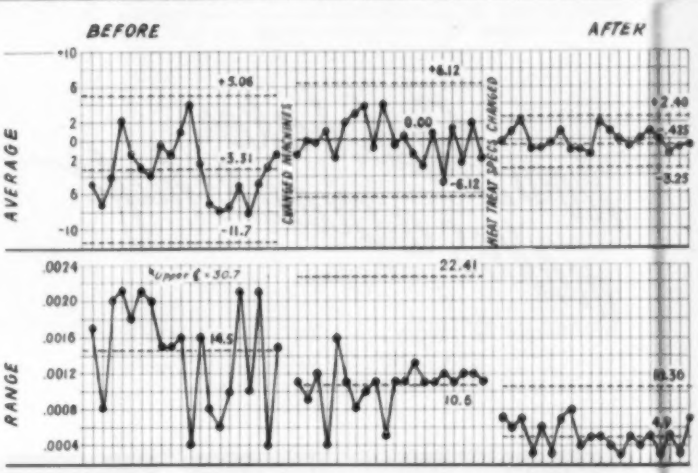
Coverage Not Complete

Coverage of all operations in Harvester plants with quality control charts is nowhere near complete. In the various Harvester plants, coverage of operations with control charts ranges from several hundred high-potential operations in a few of the plants, to 3,000 to 4,000 operations in the larger plants with high-activity jobs. One of these plants reported recently that about 5,000 dimensions are under statistical control, with some 2,500 charts in active use. This plant has increased its total number of charts in use materially during each of the four years it has been using statistical procedures, and currently estimates that it has covered about 75% of the jobs which economically could be charted.

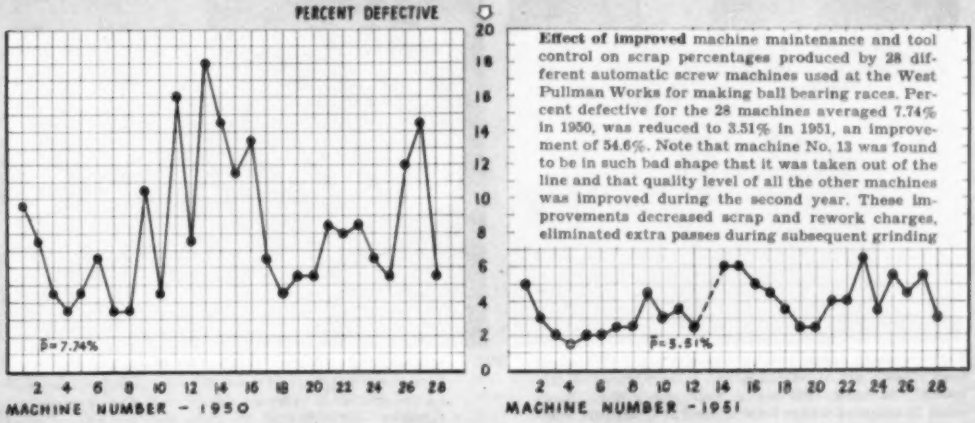
So we at Harvester know we still have a long way to go before statistical control procedures have searched out all possible quality and cost improvements in what might be called routine applications of this management tool. At the same time, we are becoming aware of additional dividends which probably can be obtained by applying statistical analysis to other jobs than the charting of data obtained when measuring critical dimensions of machined parts. We expect to see this new tool applied in wider fields as we gain more experience in its possibilities.



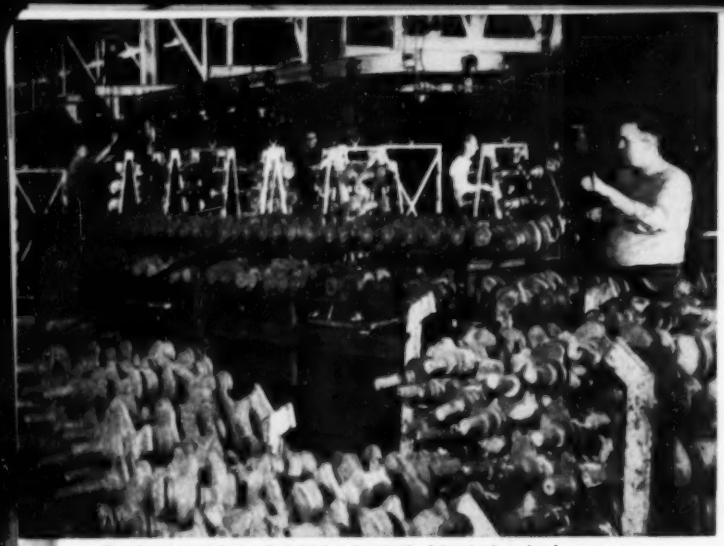
Machining rework (chart at left) cost per Silver Diamond crankcase was improved 47% last year, while scrap chargeable to the machine shop on the same crankcase (chart at right) was reduced 56% at the Indianapolis truck engine plant. Similar charts were shown by a number of other Harvester plants as proof statistical controls work



Reconstructed from portions of charts at a hobber cutting splines in a transmission main shaft, this chart shows three sets of conditions. First 20 plottings show preliminary data. The product was not uniform, scrap and rework charges were high, no matter what was done. So the job was transferred to another machine (second set of plottings) and some improvement was noted. Heat-treating specs then were changed to improve machinability without affecting quality. As shown by the third set of plottings, this brought the process under satisfactory control, and a 65% increase in hob life was realized as a result



Effect of improved machine maintenance and tool control on scrap percentages produced by 28 different automatic screw machines used at the West Pullman Works for making ball bearing races. Percent defective for the 28 machines averaged 7.74% in 1950, was reduced to 3.51% in 1951, an improvement of 54.6%. Note that machine No. 13 was found to be in such bad shape that it was taken out of the line and that quality level of all the other machines was improved during the second year. These improvements decreased scrap and rework charges, eliminated extra passes during subsequent grinding



Forgings come in by freight truck, stacked in steel racks for easy transfer to head end of line by fork-lift truck. They then are lifted to inclined three-level racks leading to spot mills

how Studebaker makes a crankshaft

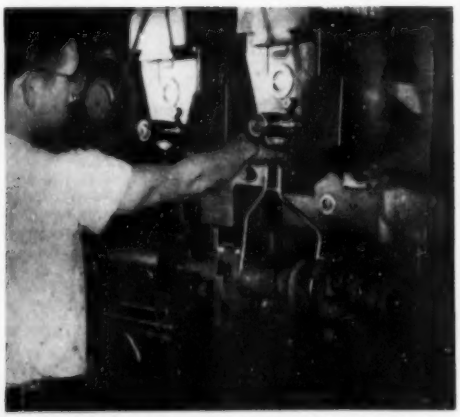
By FRED D. FOREMAN, Superintendent, Motor Division and
ORA F. MISHLER, General Foreman, Crankshafts
THE STUDEBAKER CORPORATION

FORGED four-throw steel crankshafts for the Studebaker V-8 engine are machined, dynamically balanced and finished ready for assembly in a compact production line arranged for low-cost parts movement. 50 machine tools, four dynamic balancing machines, and auxiliary units provide capacity for 75 to 80 crankshafts per hour, and are arranged in two parallel lines facing a center aisle.

Two overhead chain conveyors carry crankshaft racks along portions of the center aisle. These racks, equipped with four casters each, also are used both for stacking crankshafts in process at each machine, and for moving workpieces along the aisle in those areas not served by the conveyors. This arrangement permits easy adjustment of production rate.

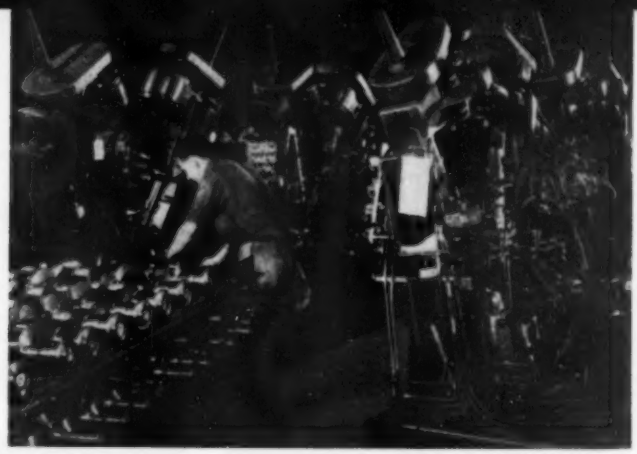
The 25 27/32-in. long rough crankshaft forgings are centered ready for machining when received. They have been heat-treated to 241 to 269 Bhn, and are reasonably straight. Rough weight is about 67 ¾ lb. Finished weight is in the neighborhood of 60 lb.

Only 29 production operations, including three straightening, a final inspection and a repair operation, produce the V-8 crankshaft. And when the line is operating at full load, only a 4-hr float is necessary to insure meeting schedules.

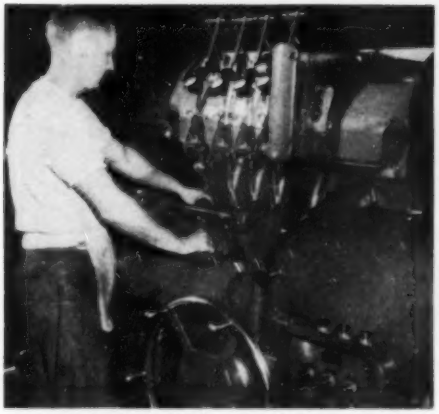


Eight locating spots, two on opposite sides of each of four cheeks, are straddled-milled in each cycle of this special Cincinnati automatic hydraulic miller. Spots must be centered within 0.002 in., and spaced apart within 0.004 in.

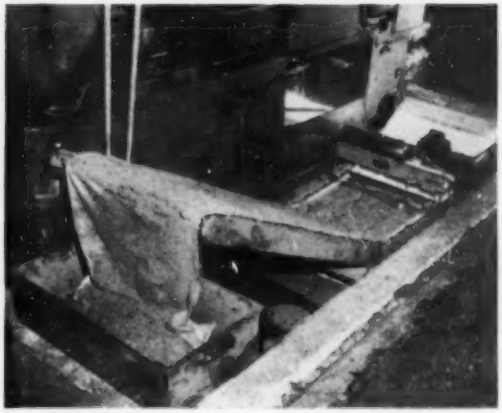
Milled spots locate the crankshaft forging in this 1-LB LeBlond crankshaft lathe for first machining operations on the five main bearings, flange, and other concentric surfaces. Air hoists on the lathe handle forgings into and out of rotating carrier



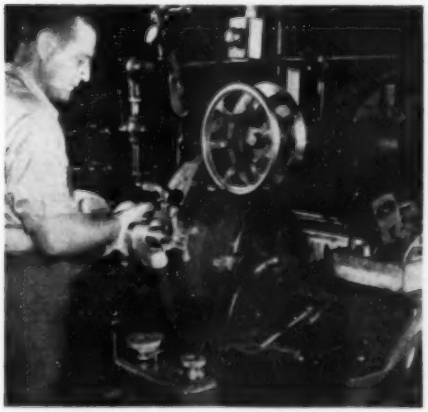
Sixth operation on four-throw crankshafts consists of drilling eight oil holes with ¼-in.-dia twist drills. Thinning webs of drills and increasing speed from 600 to 865 rpm helped cut cycle time about 30%. Four special Leland-Gifford 8-spindle drilling machines each have two work stations



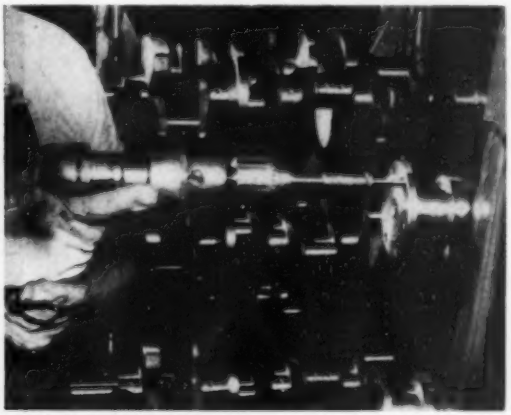
Four main bearings and the oil-seal dia are finished within 0.0005 in. on dia, and within 0.0005 in. total indicator reading on runout, in four-wheel Landis 16-IW grinders. Plunge-cut cycle is used



High-sulfur soluble oil used in the Landis IW grinders passes through nylon screens of Delpark filter units before reuse. Result is better scratch-free finish on bearings being ground



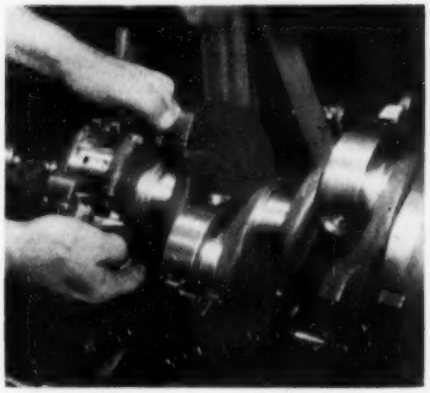
The four crankpins on each crankshaft are finished one at a time in Type D Landis 16x42-in. pin grinders. Finish is held to 5 to 7 mu in. on each of the 2-in.-dia pins. Four-arm dog fitted to end of crankshaft insures proper indexing between pins



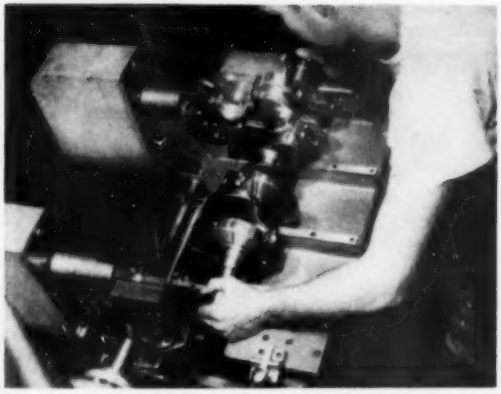
Bolt holes in flange are deburred quickly with a Cogsdill Burr-a-Way cutter in a portable air drill while machined shafts are supported on rack used to transport them from machine to machine

STUDEBAKER CRANKSHAFT *continued*

Crankshafts are balanced dynamically within 5 oz-in.^{2} with a 3.985 lb weight attached to each of the four crankpins. Two special Gisholt Dynetric balancers, each connected with a tunnel-type balance-correction drilling machine, are used in each balancing group. Three men in each group finish balance 177 shafts each 8 hr



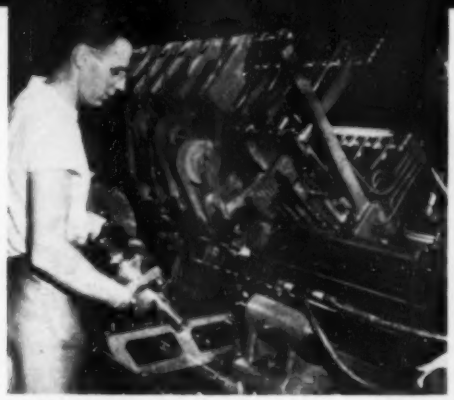
Split bob weights, each carefully dynamically balanced, are placed on each crankpin before crankshaft is put in dynamic balancer. These weights are matched so carefully that they can be shifted on a balanced crankshaft, and the assembly can be rechecked without finding measurable change in balance conditions



When balance has been checked, crankshaft is moved to special carriage for movement to adjacent correction drilling unit. Rails on carriage keep crankshaft in correct position

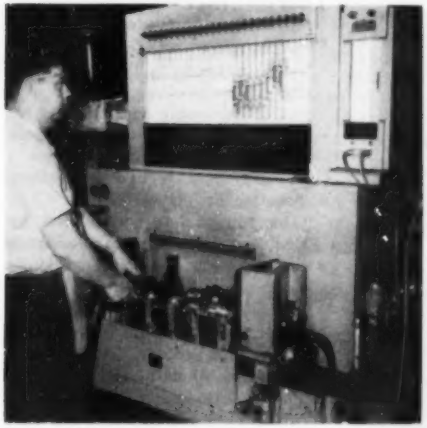
At drilling unit, crankshaft is moved from carriage to carrier for transfer into tunnel jig where counterweights will be drilled to bring crankshaft into dynamic balance. Drill spindles are set for depth automatically by controls built into balancing machine

Lever-actuated straightening unit devised by Studebaker engineers is used four times as crankshaft moves along production line. Finished shafts must be straight within 0.0015-in. total indicator reading taken against any main bearing

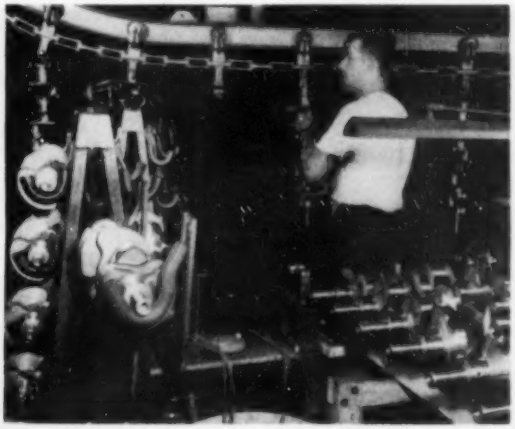


Machined crankshafts are deburred, washed in a solvent in a special spray machine, then all bearings are polished with 280-grit abrasive strips in Schraner lappers. Pin bearings are finished within 0.001 in., main bearings within 0.0005 in., in a 21-sec cycle

Lapped crankshafts again are washed in special cleaning solvent, then moved along rails through a blow-off booth on their way to the final inspector. Air cylinder drops crankshaft holder into dip tank of washing machine shown



All critical dimensions on the crankshafts are checked in two inspection cycles with this special Sheffield Precisionaire gage unit. Crankpins are checked with portable head, as shown. Concentric bearings, gear and pulley fits, and length dimensions are tested with fixed heads

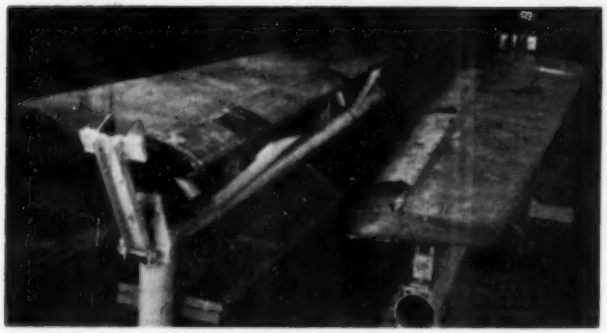


Horizontal air press at this final line station fits bushing into pilot hole in flange end of crankshaft. Operator at this position makes minor repairs as indicated by inspector, checks shaft straightness, then hangs finished workpiece on conveyor

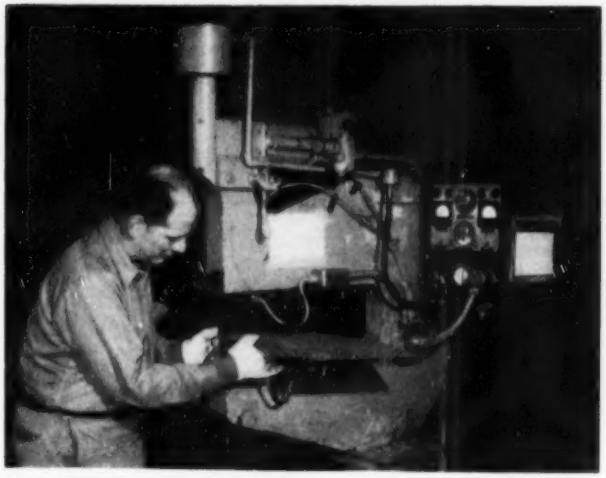
Overhead chain conveyor takes finished crankshafts direct to V-8 engine assembly line at end of Motor Division building. Floor-level slat conveyor has vertical stands on which engine blocks are bolted for assembly operations

HOT DIMPLING *forms tough aircraft skins*

BY JOHN STARR



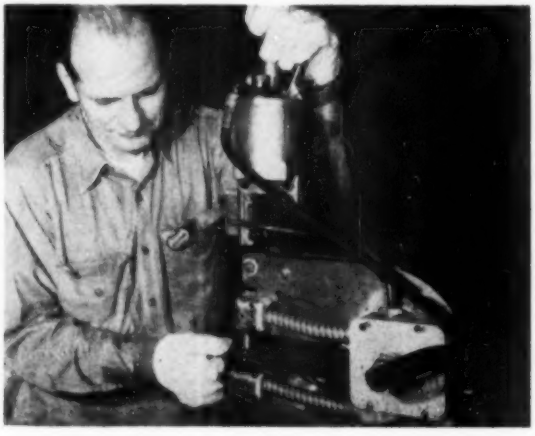
Completed elevator assemblies for F-89 have skin rivets sunk in dimpled indentations so heads are just flush with surface



Large dimpler has pneumatic cylinder for pressure, and welding-style controls for electrical heating elements in dies

Ductile aluminum is easy to cold-coin where dimples for countersunk rivets must be assembled, but tough magnesium, titanium, steel, and some aluminums are too subject to hardening and cracking for this simple process. For these sheets, Northrup Aircraft uses a new process called flow-form dimpling.

Machined dies are heated by electrical resistances in the punch and die posts, and are closed by pneumatic pressure. For most 75ST6-alloy work, contact temperature is 350F and contact time is about 20 seconds. Tests beforehand for other alloys determine temperature, time, and pressure. Advantages of the process are: Dirt and grease on the work have little effect, deburring is not necessary, and parts can be dimpled together to make them nest perfectly.



Small dimpler has only 7-in. throat, but does the same job with the same equipment

Open sectional pierce, notch, cutoff and form die for making small lever from 0.050-in. CRS strip has five heavy sections which will be dowelled and bolted to shoe after accurate alignment. Large section has five die inserts split so odd-shaped holes can be finished in surface grinders

Sectional dies are easier to finish...

Greater accuracy is required in finishing the individual sections, but hand filing of irregular die openings is minimized, points out Herbert Harig, in an interview with . . .

BEN C. BROSHEER, ASSOCIATE EDITOR

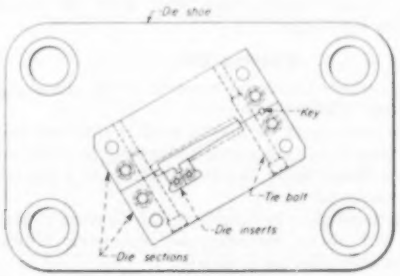
SECTIONAL perforating and blanking dies have many advantages over the conventional solid type. This is especially true when the blank profile is irregular and the die opening is difficult to finish. Progressive dies are a "natural" for sectionalizing, particularly when a series of operations are to be performed on small parts and the die openings are non-circular.

To bring you the principles of sectional-die construction, we interviewed Herbert Harig, vice-president of the Harig Manufacturing Co., Chicago. This shop, a member of the National Tool & Die Manufacturers Association, builds sectional dies as a regular thing for various customers.

In Mr. Harig's experience, the principles to be discussed are applicable to die members made either from hardened tool steel or cemented carbides. True, these die materials require different methods of anchoring. However, sectional design often makes it possible to minimize tool cost and provide the best service through using both steel and carbide sections in the same die. Application of the two materials depends, of course, on the work done at the various die stations.

Sectional construction involves the production of

Diemaker here is assembling eight finished sections into 9x10-in. pocket milled ½ in. deep into top of die shoe. Hard steel liners ½ in. wide are inserted along two sides of pocket to prevent shifting of ends of sections against soft walls of the pocket. They are finished last, so tight fit in pocket is insured



Two large sections for inverted compound pierce and blank die for cutting spring from 0.010-in. nickel silver strip have two through (cross) bolts to eliminate spreading under pressure. Two inserts in one section permit surface-grinding form to cut ear on spring. Key between sections prevents sidewise shifting

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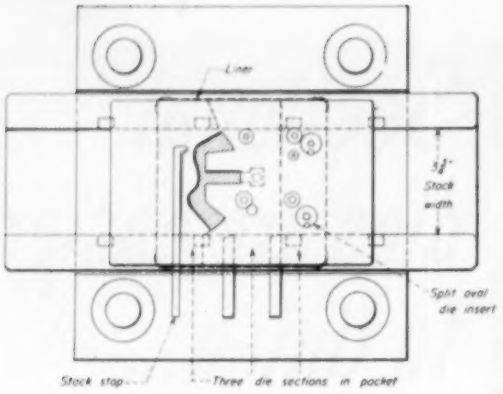
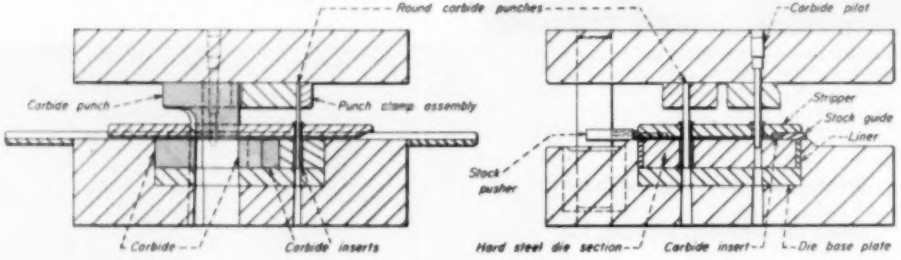


Carbide progressive die for piercing and blanking laminations from 0.020-in. silicon-steel strip has two carbide sections (one with insert) and a hard steel section in pocket. A ⅝-in. plate is placed in bottom of pocket to support sections, and 0.175-in. hard steel liners face two sides of pocket to keep sections from shifting



the die member by building it up from a group of small sections of relatively simple shape. These sections, when assembled and locked together, leave blank openings of the size and shape required for clearance of perforating and blanking punches. Usually section lines are across the blank openings, so that walls of these openings can be finished on a surface grinder.

Making die sections in simple, easy-to-work shapes is of distinct advantage in the construction of steel dies. These sections are easier to heat-treat than solid dies. Shrinkage and cracking problems are minimized. Warpage generally is eliminated. And the sections can be ground all over, permitting removal of any decarburized skin, with the result that dies last longer.

Blanking Dies

Two considerations are essential when designing a sectional blanking die:

1. Sections must be shaped so that they are self supporting, or are supported adequately by adjacent sections. There must be no possibility of a section tilting under pressure.

2. Sections must be locked rigidly together so that there will be no spreading or separating of the sections when the die is in use.

Where sections are large with relation to blank size, and the punches produce little or no side thrust as they are forced through the stock, the die sections can be bolted and dowelled directly to the die shoe. Or the sections can be fastened to a mounting plate, which later is attached to the shoe. At times, cross bolts are run through the sections to lock them together. This design is cheapest, but better die life generally is obtained when the sections are confined by some type of retaining wall.

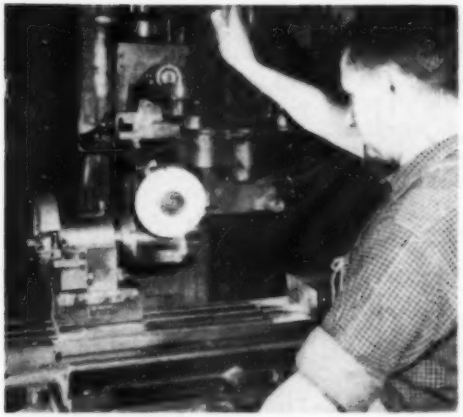
Methods generally preferred for confining die sections to prevent movement in use are:

1. Set sections into bottomed four-sided pocket milled into die shoe or mounting block. Hard steel bottom plates and side liners can be used to minimize any possible spreading of the soft shoe. Thus, sections will not loosen under repeated application of pressure. Sections still are bolted in place to prevent shifting.

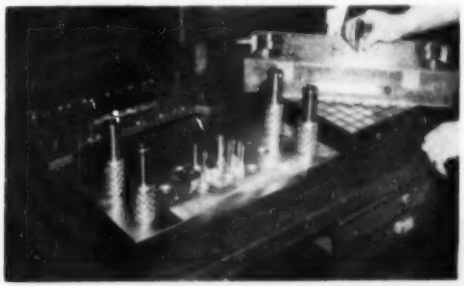
2. Because closed pockets are difficult to machine accurately, die sections often are mounted in open-end slots machined in the shoe or mounting block. This permits economic grinding of slot walls. Through (cross) bolts can be employed where sections are not large enough to resist side thrusts toward open ends of the slot.

3. Where cross bolts are not desirable, and the die-section assembly should be confined on all four sides, ends of slot in shoe or block can be closed with heavy cross keys. At times these keys can be die sections in themselves.

4. Where a tighter hold on the section assembly is desired, the sections can be confined in a heavy steel yoke with a square or rectangular opening. The walls can be ground accurately to size. In dies using the yoke construction, the assembly of die sections generally is made about 0.003-in. larger each way, and the yoke is warmed slightly before die members are pressed into place. The yoke should



Precision surface grinders do most finishing of die sections of type described. This No. 2 Brown & Sharpe has a special Harig-designed index head and a Moore pantograph-type diamond dresser to increase its adaptability for die section work



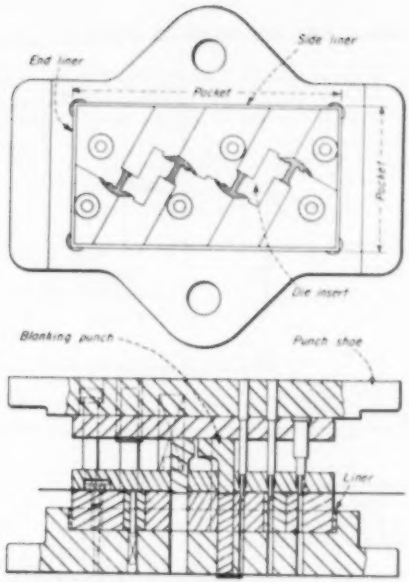
Final inspection operations are being performed on this progressive die for piercing and blanking pole-piece laminations for a small electric motor. Die sections are in slot in shoe on surface plate. Heavy keys close ends of slot to lock sections tightly

not be confused with the shrink ring sometimes used to lock round die assemblies together, because confinement pressure is kept to a minimum when a yoke is used.

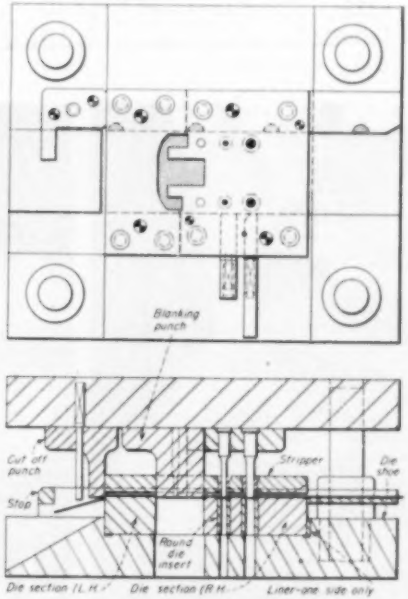
Die sections must fit into the retainer tightly, but assembly pressure must never be so great as to cause "bridging" and bowing of the shoe.

Sectional construction has not been found desirable for punch assemblies, except in isolated instances. Rather, punches should be mounted separately, so some adjustment for alignment is possible when the die is assembled. Likewise, it is desirable that punch guides on strippers have some adjustment.

Sectional die construction calls for a high degree of accuracy when finishing the individual sections. But these sections are easier to work with, and their use virtually eliminates the tedious hand filing formerly needed when finishing irregular profiles in solid dies.

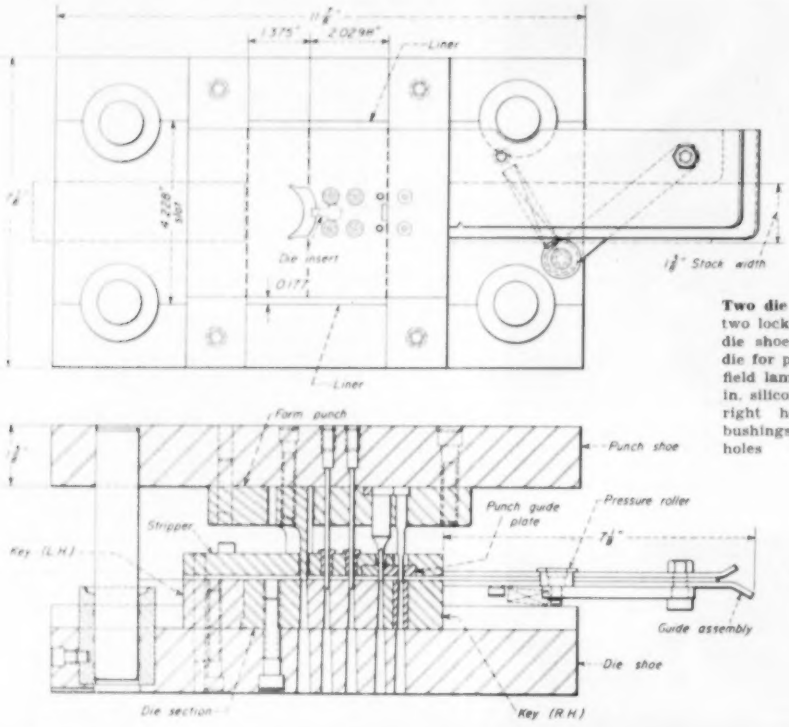


Tandem blank and push-through die for making two small stator laminations per stroke from 0.025-in. silicon-steel strip has ten sections and two inserts in blanking assembly. Angular setting of sections, necessary to position die openings for economic cutting of pieces from narrow strip, calls for hard liners all around pocket

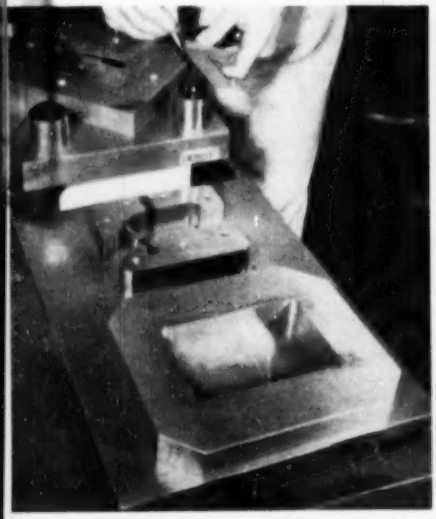


Two heavy hard-steel sections of this progressive pierce-and-blank die for making 0.0625-in. laminations are set and bolted in 6.065-in. slot machined longitudinally in steel die shoe. Large size of sections permits enough hold-down bolts and dowels to prevent any shifting of the sections, so end keys are not needed

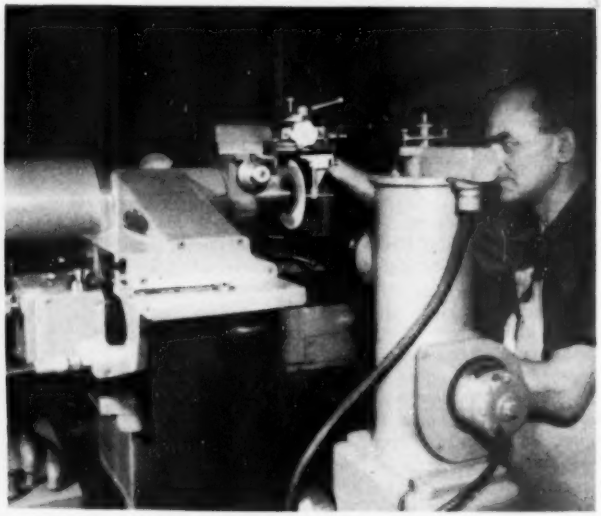
PLEASE TURN PAGE



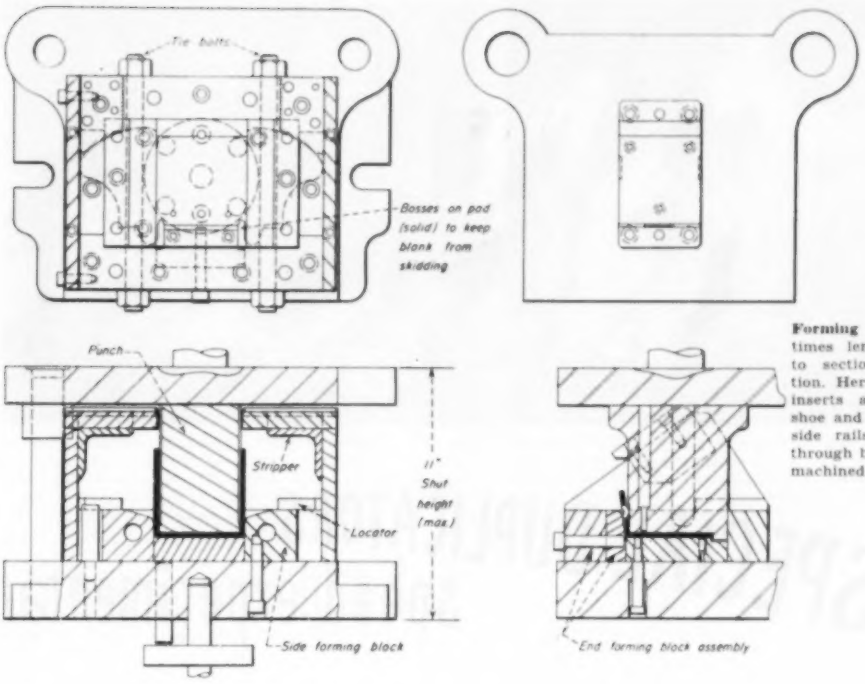
Two die sections in slot and two locking keys are used in die shoe of this progressive die for piercing and blanking field laminations from 0.0187-in. silicon steel strip. Key at right holds two die-insert bushings for piercing small holes



Yoke and three die sections (one with separate insert) for yoke-type sectional die assembly are shown on surface plate in foreground. Diemaker is scribing second yoke (with die sections in place) for machining to match die shoe

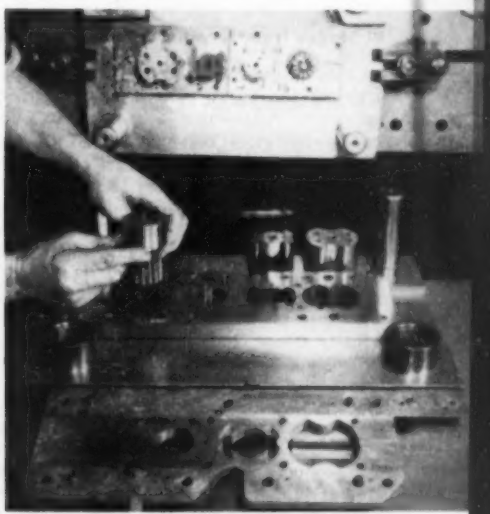


Latest Harig addition for precision finishing of die sections and similar parts in this Cincinnati Projecto-Form grinder in which view of surface being finished is projected on screen at 20-1 enlargement. Changing machine adjustment gives 40-to-1 enlargement



Forming dies sometimes lend themselves to sectional construction. Here two forming inserts are bolted to shoe and are locked to side rails with heavy through bolts and steps machined in rails

Round holes in die sections and inserts are finished, including clearance tapers, in Moore jig grinders. Two of these machines have automatic spindle reciprocation, permitting the grinding of non-circular holes by reciprocating spindle while moving table



Accuracy of punch and die grinding is proven by this check of a lamination die mounted in a Moore die assembly unit. Punches made for a duplicate die fit perfectly in die openings, just as do those in the punch assembly on the turnover head

Experimental blades for jet-engine research include subsonic, transonic, and supersonic types for compressors and turbines. Wide variation among blades requires flexibility in manufacturing techniques

SPECIAL DUPLICATORS speed experimental

Continued improvement in methods has resulted in unusual contouring techniques at the Lewis Flight Propulsion Laboratory. Included is new spark-gap duplicator that produces three-dimensional blades from two-dimensional templets and eventual replacement of templets with punched cards

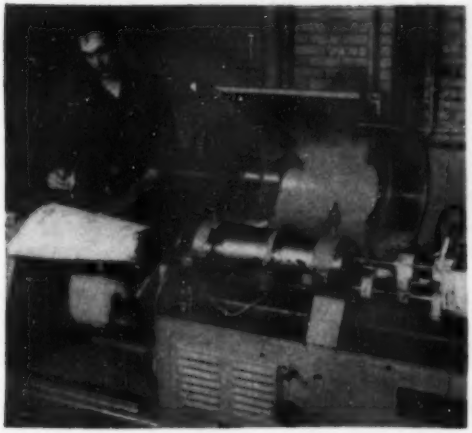
BY MILES J. ROWAN, ASSOCIATE EDITOR

To get the facts that will permit designers to make the best possible use of jet power, the Lewis Flight Propulsion Laboratory is carrying on a continuing program of research into all phases of jet propulsion. An establishment of the National Advisory Committee for Aeronautics, the Laboratory has facilities valued at neary $100,000,000. At present, some 2700 scientists and technicians are working in the Laboratory on projects that involve virtually every element in jet-engine design and construction. Of these projects, one of the most important is the study of compressor and turbine blading.

Blades must operate under a variety of conditions in subsonic, transonic, and supersonic compressors. What happens within a compressor during flight involves complex theories of aerodynamics and fluid mechanics. The fastest and most reliable way to learn the effect of changes in blade design is to test the blades under conditions simulating actual flight. Blades must be produced, set up in compressor test rigs, and run. In some cases, single-stage compressors are all that is needed, in other cases, several stages, or perhaps an entire compressor, may be required.

For the most part, quantities required of any one blade are low, yet the total required for all projects is large. At the same time, blades vary widely as to size, shape, tolerance, and material, and many involve complex machining problems. To produce these blades at minimum cost and in the shortest possible time, the Laboratory employs a wide variety of duplicating machines, some of which are standard, while others are entirely special, designed particularly for blade milling, and involving principles quite different from those of any machine on the market.

In this group are a new blade mill with an electronic tracing head and a special tracing system that eliminates the need for three-dimensional masters, two special mills designed for mechanical duplication through pantograph linkage, and a fourth mill of similar design but including hydraulic duplication. Standard machines include Gorton vertical mills, Cincinnati Hydrotels, and a number of conventional machine tools. Each machine is best suited for a given class of work. Together they provide the



Airfoil machine duplicates shape of master made six times blade size. Follower controls movements of cutter through pantograph. Bar stock feeds through spindle past cutter. Mechanical duplication and supported work contripute to high degree of accuracy

Templet layout calls for accurate location of points on blade contour as established by *X* and *Y* coordinates specified on drawing. Cincinnati layout machine provides fast, easy method for consistent measurements to vernier accuracy. Templets are six times blade size.

jet-engine blades

flexibility required to produce a large variety of blades with minimum tooling costs.

Of the standard machines, the familiar Hydrotel, because of its speed, handles the majority of orders when tolerances are within its capabilities. Short blades, or those with heavy sections, can be milled readily to relatively close tolerances. As the work is held at the root, however, the Laboratory has found that there is some tendency toward deflection under the cut, and this must be considered in deciding what jobs can be run on this machine.

Pantograph-type Mills

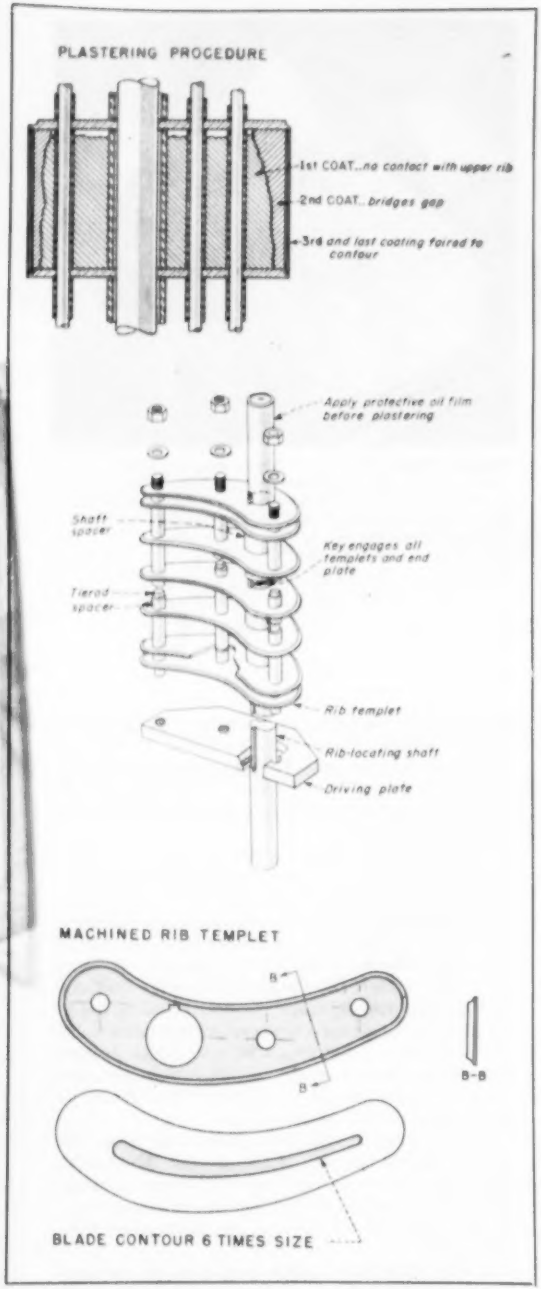
Extremely accurate, but only 75% as fast as the Hydrotels, are the pantograph-type mills. Stock feeds past the cutter, and all cuts are taken close to the face of the chuck. As the work is well supported, heavy cuts can be taken with little danger of deflection. All contouring movements of the cutter are controlled by a follower that traces a rotating master. Resulting motions are transmitted to the cutter through a 6 to 1 pantograph linkage. Thus, any inaccuracy in the master will cause an error in the work that is only one-sixth that of the error in the master.

Blades are made of rectangular bar stock that is fed through the machine spindle. Bars up to 24 in. long can be accommodated. Stock is held in a collet adjusted to grip the bar firmly, yet to permit continuous feeding during the cycle. Graphite grease is wiped on the bar. Feeding is accomplished by a leadscrews that advance a collar attached to a pusher within the spindle. Normally, feed is approximately 1/16 ipr. Spindle speed averages ½ rpm, with 2 rpm the maximum. Cutter speed is 60 fpm for mild steel, and varies according to the material being cut.

Tracing is done with a wheel mounted on a lever that pivots about its own support as the master rotates. This motion is transmitted mechanically to a second lever that supports the cutter and causes the cutter to duplicate the shape of the master in the work. The lever arm of the wheel is six times that of the cutter. The radius of the wheel, however, is 1 in. less than six times the cutter radius, the 1-in. differential being necessary to compensate for the fact that the master is 1 in. oversize all around. Lengthwise motion of the tracing arm is provided by a leadscrew geared to advance the tracer at six times the feed rate of the stock.

Limit switches stop both leadscrews when the tracer reaches the end of the master. The switch controlling the stock feed, however, also sets a timer. This allows sufficient time for the cutter to clean up the helix at the base of the blade, then stops the spindle.

Blades with chord length up to 4 in. can be made on these mills. Blades of greater chord length, up to 14 in. maximum, are made on another mill that has a special hydraulic duplicating system as well as a pantograph linkage. The pantograph operates in the same way as on the mill just described and controls



Three-dimensional masters are made by assembling templets that represents sections through blades, then filling the assembly with plaster. Keyed center-hole maintains angular relationship of templet. Job requires precision work and skilled craftsmen

the motion of a finishing cutter. The hydraulic unit controls a second cutter that takes a roughing cut on the blade. Both cutters operate simultaneously to cut milling time on large blades requiring heavy cuts.

How Masters Are Made

Both of these methods require three-dimensional masters, which must be made by skilled craftsmen working to close limits. To minimize the time and cost of the operation, the Laboratory has developed a standard method for producing masters from plaster and sheet metal.

The master consists of a series of thin templets, each made to the contour of a cross-section of the blade, all held together with pins and separated by spacers so each templet is positioned lengthwise in the master at the exact location for which the cross-section is specified. This assembly is filled with plaster, the excess being removed with a flexible plastic straightedge that is held in contact with the edges of at least three templets at all times. In this way, all base points established by the templets are connected by smooth contours, resulting in a three-dimensional master that is an accurate reproduction of the blade shape specified on the drawing.

The number of templets prepared for each master equals the number of sections specified on the drawing. The lengthwise location of each section is given, and its shape is defined by a series of X and Y coordinates from a given reference. These points are laid out six times actual size on a thin brass or aluminum plate on a Cincinnati layout machine. An allowance of 1 in. is made all around to increase the stiffness of the master and to insure sufficient stock to permit assembly even on small blades and on those with considerable twist. After layout, templets are sawed, then filed to exact size.

Templets are located in correct angular relationship by a keyed shaft that is a press fit in the keyway of the large center hole of the templet. Tie-rod holes are held within 0.0005 in. of the tie-rod size. All holes are line-bored to insure blade-angle accuracy. Shaft and tie-rod spacers are ground to length.

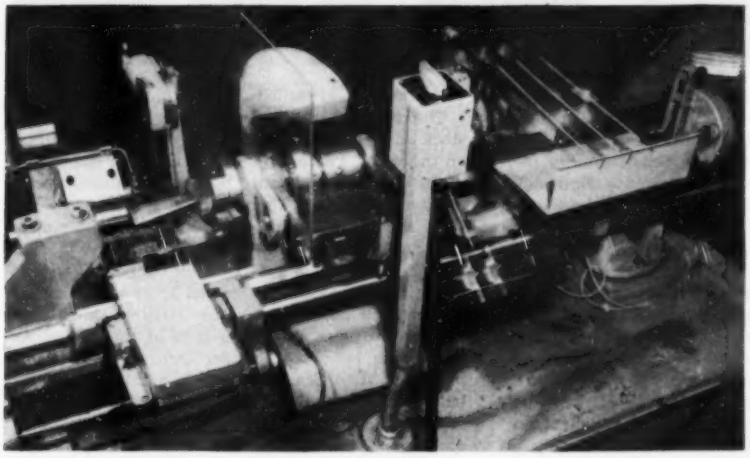
While the mechanical assembly must be accurate, considerable care also must be taken during plastering to avoid distortion. The first coat does not touch the upper rib, the second bridges the gap left by the first coat but does not fill the opening; the third, and any subsequent layers, must be smoothed to the templet outline with a straighedge that contacts at least three templets simultaneously.

Masters require a large number of manhours, the exact number depending upon the size of the blade, accuracy required, and the number of points or sections required by the drawing. Simplifying this procedure considerably, for work within the capacity of the machine, is the new blade mill with spark-gap duplication.

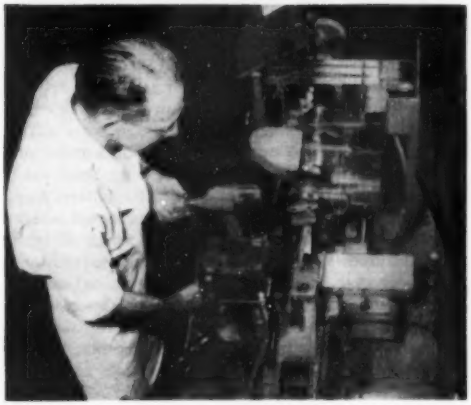
Spark-Gap Duplicator

Newest machine in the shop and one based on an entirely new principle of tracing is a spark-gap

New blade mill has cut time for preparing Hydrotel masters from an average of five days to less than one day. Machine is based on new system of spark-gap duplicating that produces three-dimensional blades without a three-dimensional master. Tracing unit is at left, milling head is on carriage at right

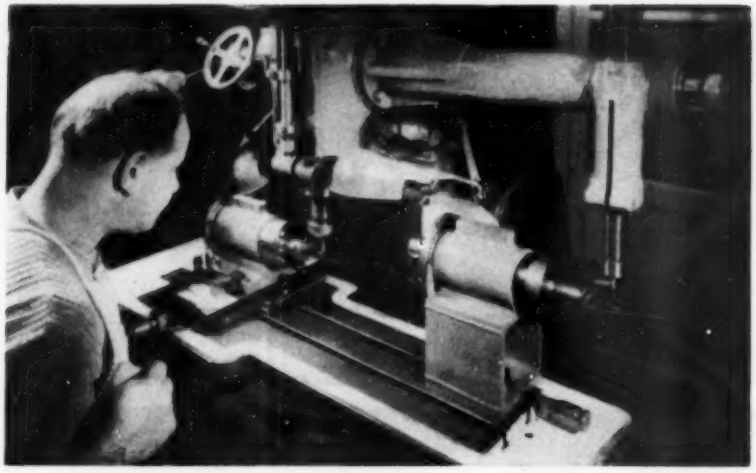


Milling head duplicates motions of tracing head through action of servo-mechanism, lower left. Movement of tracer varies current to servo and controls direction of carriage transverse feed. At lower right is second spark-gap duplicator that controls amount of twist in blade automatically



Spark-gap duplicator traces without pressure. Two-dimensional templets revolve at same speed as work, and, through followers, move thin blades back and forth in frame above templets. Movements flex strip held on magnetized ends of blades, producing contour that tracer follows. Strip takes place of three-dimensional master

Blade-measuring machine outlines shape of blade on photographic paper which passes through machine while the blade feeds between measuring points. Scale at top aids operator in setting chord line at right angle to measuring point. Machine is fastest checking method for small-lot orders produced in Laboratory



Root-fairing operation blends airfoil section to rotor contour. Standard hand-controlled mechanical duplicator provides required accuracy and ample capacity for present production

duplicator built by the New England Special Machine Co. This machine traces without pressure, does not require a three-dimensional master, and has slashed 80 to 85% from the time formerly required for producing masters for the Hydrotel. Masters that required an average of five days now can be made in less than eight hours. Blade orders, as well as masters, also can be run on this machine. It is particularly well-suited to small-lot orders as its setup time is less than that of any other machine in the shop, even though its run time is somewhat longer than for the other mills because of its relatively light construction. Later models are being built for heavier work at faster speeds.

The machine, which is the first of its kind, is built on a small lathe bed. Pieces are chucked on one end and are supported on the other end by a dead center in the machine tailstock. The milling head is mounted on a carriage that feeds at constant feed along the ways. Transverse motions are provided by the carriage cross-slide. Power for these motions is supplied by a servo-mechanism that is controlled by the duplicator. Signals from the tracing head actuate one of two electro-mechanical clutches to provide either "in" or "out" feed on the slide. Clutch faces are in contact at all times and slip continuously at the same rate when no transverse motion is called for by the tracing unit.

Solid ceramic blade was made by hot pressing in graphite mold. Final size was obtained by grinding

The tracing unit is mounted behind the headstock on a second carriage that is locked in position on the ways. The master shape, which is duplicated in the work, is established by two-dimensional templets mounted on a mandrel that is driven by the same spindle that rotates the work. As the templets rotate, a follower on each templet moves a thin steel blade back and forth in a supporting frame above the templets. Magnetized knife-edges on the end of each blade hold a thin strip of shim stock securely in place across the ends of the blades. As the blades reciprocate under control of the templets, the strip flexes to provide a smooth contour between points of contact with the blades. In effect, the continually changing strip furnishes a three-dimensional surface.

The tracing head follows these contours without actually contacting the strip. A steady spark given off by the head maintains a gap of 0.0015 in. between the head and the strip. To maintain this gap as the strip moves, the tracing head is driven transversely by a mechanical followup linkage connecting the tracing head to the carriage cross slide. In this way every transverse motion of a point on the flexible strip adjacent to the tracing head produces an equal transverse motion of the cutter. Any change in the length of gap produces a signal which is amplified and fed to the clutches, which in turn move the cross-slide and the tracing head to counteract the change in gap length. Longitudinal movements of the tracing head and cutter also are the same as the follow-up linkage is fed along the machine by the carriage feed. As this is a one-to-one relationship between rotation of the work and rotation of the templets, the cutter accurately reproduces the shape of the developed contour in the work.

The use of two-dimensional templets to flex a strip from which all tracing is done eliminates the need for a three-dimensional master and saves a considerable amount of time whenever a few blades

or a Hydrotel master must be produced. Only enough templets to determine the shape of the blade are required. In some cases, three templets are enough, in others, five or seven are needed, depending upon the complexity of the shape and the tolerances involved. As only straight templets are required, they are produced readily on a Gorton 3L pantograph. Tracing is done from thin metal templets laid out to drawing specifications.

How Twist Is Obtained

Both straight and twisted blades can be machined, as well as tapered blades and those with constant airfoil section. Twist is produced in a blade by advancing the templets the required number of degrees relative to the work while the milling operation takes place. Therefore, if a blade requires a 30° twist, the templets at the end of the operation will have advanced 30° ahead of the work. This is accomplished by a second spark-gap duplicator at the rear of the machine. Knife-edge blades, in this case, are set up in a fixed position at the correct height relative to one another to provide, in effect, a mechanical graph of twist required vs. blade length. One end of the tracing head is set in relation to the location of a tapered collar having an internal spiral that controls the degree of rotation of the templet. The other end follows the contour strip and controls the motor that moves the tapered collar axially, thus rotating the master relative to the work.

For blades of varying airfoil section, enough templets are required to establish the contour. However, for blades of constant airfoil section, either straight or twisted, only one templet is required.

Both the cutting and the tracing heads move at a constant rate of feed that can be varied infinitely by rheostat. The speed of cutter rotation is variable and the speed of work rotation can be changed automatically during each revolution by means of a cam on the templet mandrel. The cam can be set to operate a switch that reduces speed on those sections of the contour requiring slower work rotation.

Punched Cards Control Tracing

While the present system of flexible-strip duplication saves a great deal of time through eliminating the need for three-dimensional masters, still greater savings will be obtained from a new system now under development at the Laboratory. This system will eliminate all masters or templets, and will control the New England blade mill directly from punched cards. The same coordinate data now used for templet layout will be punched on the cards. These will be fed into Laboratory-designed electronic computers, one for each section specified for the blade. Each computer will develop exactly the same motion as the corresponding templet in the present machine, thus flexing the strip exactly as the templets do at present. Punching will be a fast, machine operation, performed from the drawing. As all manual layout will be eliminated, the new method will not only be faster and less costly but also will permit greater accuracy than normally can be expected at present.

Photographic Blade Measuring

All blades now are checked in a special machine that reduces the time for inspection to approximately half that formerly required. While the machine currently in use was obtained from a commercial builder, the principle upon which it is based was developed in the Laboratory approximately four years ago.

Blades are mounted on a slide with blade vertical and the leading edge in the direction of slide movement. The slide advances the blade at a constant rate between two measuring points. These, through an optical linkage, trace the outline of the blade on photographic paper at 20 times actual size. Checks are made at each section specified on the drawing. Resulting outlines then are compared with drawing specifications. To simplify the comparison, the paper is lined with 0.025-in. divisions.

Both the blade and the paper pass through the machine at constant feed rates, (paper is actually moving at 20 times blade rate to obtain magnification), both being driven by synchronous motors. Setup is speeded by lights in the scale above the blades. When the blade is correctly aligned on the slide, the lights, which move back and forth across the scale depending upon the amount of deflection of the measuring points, will rest at the same scale value for both the leading and trailing edge of the blade.

Following completion of the blade-milling operations, any number of different bases may be required. While form-milling and form-grinding on crush-trued wheels are the techniques most commonly employed, completely special lathe setups sometimes must be made. Blades then are set up on duplicator-controlled profiling machines for the root-fairing operation which blends the airfoil into the rotor contour.

While the majority of blades are made from materials such as aluminum, SAE 4340, stainless steel, Inconel, and others, some of which are extremely tough, but nonetheless machinable, some blades are made of materials that can not be cut. Some heat-resistant metal blades, ceramic blades and those of molybdenum di-silicide, a material similar to tungsten carbide, are in this class. For these materials, investment casting or grinding usually is the answer.

In one case, blades were hot-pressed to rough shape in graphite molds, then were ground to dimension in a Cleveland reflection grinder. Molds first were placed in an induction-heater coil; a hydraulic jack then was used for the hot-pressing operation.

With these methods, the full range of subsonic, transonic, and supersonic compressor blades, as well as turbine blades for aerodynamic research, blade-cooling research, and blade-material research, can be produced. Tooling costs can be held to a minimum and delivery times planned so research is not delayed through lack of experimental blades.

SPRAY and SINTER

to make high temperature alloy parts...

Demand for mechanical components of refractory and high-melting-point alloys is rapidly increasing. As heat-resistance rises, machinability ratings usually decrease, hence forming and cutting are not always feasible. One answer is metal spray; building up material on a removable mandrel, rather than cutting to produce a desired size. Navy BuOrd Technical Task research showed how to do it. The techniques are widely applicable

BY JAMES E. CLINE
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Metal-spraying, heretofore used almost entirely for coating and surfacing, can be considered as a forming technique for large objects, beyond the practical limits of powder-metal tooling and presses. "Spray metallurgy" is a form of powder metallurgy, except that plastic metal particles are shaped by force of impact rather than ordinary mechanical compaction. Most metals, except certain tungsten alloys, may be sprayed by the available methods.

Porous metal-spray coats of high-chromium steels and chromium-nickel alloys have been prepared commercially. But little work has been reported on either the metal spraying of high-melting-point materials or the production of solid bodies from these materials by spraying. Molybdenum and Stellite are rather widely used commercially, but only limited data are published about them. Similarly, available literature scarcely mentions improvement of the mechanical properties of sprayed-metal deposits by subsequent heat-treatment. Although coatings of sprayed aluminum on steel (aluminizing) are heat treated commercially, the general practice is discouraged because of volume changes which cause coating failure by cracking.

The technique described here was limited to the wire-fed spray gun for several reasons. Oxidation during spraying is less; deposit is more dense; the object being sprayed may be maintained at a lower temperature conveniently.

Thin-walled bodies of rotational symmetry impossible, or impractical, to form by powder metallurgy, casting, forging, or machining from the solid can be produced by metal spraying, followed by sintering in a reducing atmosphere. Maximum density is imperative to achieve optimum mechanical properties. Porosity and oxide content of an as-sprayed body determine its usefulness. However densification and removal of oxides are much improved if a liquid metallic phase of sufficient quantity is formed during sintering. At present, it is difficult, if not impossible, to achieve bulk density with pure metals. Total removal of oxide by hydrogen reduction is hindered by the difficult removal of entrapped water vapor in the later sintering stages. (*Total* removal of oxide will sometimes lower part strength — Ed).

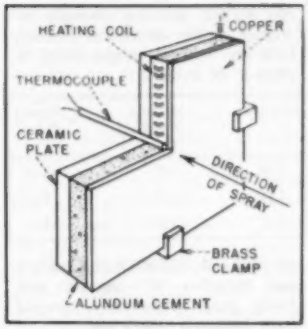
It is also possible to spray and sinter certain shapes of nonrotational symmetry, but shrinkage cracks occur readily unless sufficient liquid phase is formed before appreciable densification takes place. In this respect, stresses developed during the shrinkage of deposits on flat surfaces will either peel or crack the deposit. This may even occur during spraying of thicker deposits on plane surfaces.

At this point, readers may feel that spraying is hardly worth the effort. Actually it is often practical. Though optimum physical properties are seldom reached, they also are seldom called for. Component mechanical limits will often permit practical application of spray-forming techniques. The methods described herein have produced a quality of structure well within usable limits. The most important point to remember is that when sintering is required, *a liquid phase should be maintained during the final stages of hydrogen sintering* for maximum physical properties.

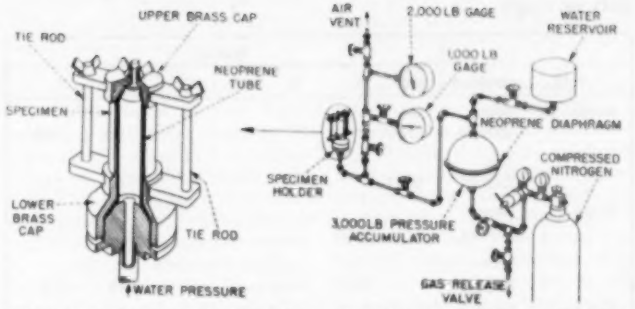
In general, the manufacture of whole parts by spraying metals or alloys and subsequent sintering for maximum density is, like most powder-metallurgy processes, limited to products which either cannot be made otherwise or as cheaply. One outstanding example of this is the dense hollow body of high-melting-point alloy.

Spray Process

Drawn wire or cast rod of the metal or alloy to be sprayed is fed through the center of an oxy-acetylene flame by a gear train driven by an air turbine. The metal, upon melting, is atomized by a compressed-air blast which surrounds the flame. The sprayed metal particles are still at their melting point when they reach the object being metallized. (This was determined in experiments performed as a preliminary to this project). Upon impact the particles readily collapse; assume the contour of the surface they strike, roughly resembling a random stack of mini-



Impact temperature of sprayed metal particles was determined by establishing a heat balance between the copper surface of this electrically heated target and the sprayed metal



Hydrostatic test was used to determine bursting strength as this was considered more reliable than tensile test bars. The latter tended to fracture at shoulders (a more recent design is said to correct this); thus give inconsistent readings. Cylindrical form of work was especially adaptable to the above testing method

ature flapjacks, all overlapping.

Mandrels are made of graphite tubes fitted over steel shafts and slightly roughened to cause the particles to stick. Graphite mandrels are seldom satisfactory for any but cylindrical shapes. It is very difficult to get sprayed particles to stick on flat graphite surfaces.

For most cylindrical parts, graphite mandrels are provided with draft to permit pressing the part off the mandrel after forming. Prior to sintering the part is removed from the mandrel by pressing, or by machining out the mandrel if the internal configuration prevents the use of draft. A high-temperature ceramic cylinder is inserted into the part to prevent it from collapsing at the high sintering temperature. This ceramic cylinder must be a good fit, conforming closely to the sprayed part shape. Cylinders are readily removed after sintering.

National Carbon Co. AGX graphite sleeves were fitted to ¾-in. dia steel shafts to serve as the mandrels. This material has excellent machinability and a good, smooth finish is readily obtained. After the graphite sleeve had been machined to 1.125-in. dia, the assembly was rotated in a lathe and sprayed with a coating of metal, using ⅛-in.-dia metal wire or rod and a Metco style spray gun. Acetylene was used in combination with oxygen and compressed air.

In a previous experiment it was determined that a distance of 5 to 6 in. between the nozzle of the gun and the mandrel was most satisfactory for spraying molybdenum. For these pieces a 5½-in. distance was used. A maximum range of 1 in., or ½ in. on each side of the ideal distance, is the greatest variation permissible for good coating. Of six pure metals tested in a previous experiment (copper, molybdenum, aluminum, iron, nickel, and zinc), all were sprayed at a distance of 5½ in. from the test piece except iron and zinc. These were sprayed at 8 in. When iron was sprayed at 5½ in., the temperature of the deposit permitted excessive oxidation. This liberated enough heat to cause local melting of the deposit. Spraying zinc at 5½ in. resulted in the temperature of the impinging flame being high enough to melt the deposit; thus cause it to drip from the target. Spraying both of these at 8 in. alleviated the problem. *However, many factors determine the proper distance for any given job.* These things include: material, gun-size, air pressure, temperature, and feed rate. Ideal distance should be calculated to suit each new job.

After spraying, the metal coating was dry-ground to 1.155 in. with a high-speed toolpost grinder, to leave a 0.015-in. wall sleeve. The steel shaft was pressed out and a cylinder 2 in. long was removed from the center portion of the spray coat. The graphite was removed from the 2-in. section of sprayed metal and the internal surface paper polished. This piece, as-sprayed, was then hydrostatically tested for bursting strength.

Many different alloys were sprayed successfully. Among these metals were Vitallium, which was sprayed from hot-swaged rod, and Hastelloy C and CM-469, which were sprayed from as-cast rod prepared in the laboratory. Melts of the last two alloys were made in a 5-lb high-frequency induction furnace. Molten metal was drawn from the crucible by vacuum into Vycor glass tubes, producing rods approximately 12 in. long. After solidification, the glass was removed and the short lengths welded together, using atomic hydrogen, into lengths of 5 ft or more.

Sintering

As the strength of sprayed metals is largely affected by the quantity of oxide and by the number of voids the coating contains, sintering in hydrogen at elevated temperatures was done to improve strength. All of the pieces were sintered in hydrogen in a 1½-in. combustion tube, heated in a 2-kw Globar furnace. The hydrogen was passed through a purification train to assure freedom from oxygen and water vapor.

Sintering the first molybdenum specimen for 15 min. at 1350C improved the strength only slightly over the as-sprayed deposit. As

CHEMICAL COMPOSITION *of sprayed metal changes with spraying. Material picks up oxygen . . .*

Metal	Condition	Analysis						
		Mo	Ni	Cr	Fe	Co	C	O_2
Molybdenum	Before Spraying	99.95					0.026	0.009
	After Spraying	96.43					0.016	3.55
Nickel	Before Spraying		99.94				0.05	0.008
	After Spraying		99.72				0.05	0.25
Vitallium	Before Spraying	5.79	2.47	27.0	1.48	59.96	0.27	0.058
	After Spraying	5.58	2.64	26.3	1.57	59.58	0.19	0.42

WITH 1-HR HYDROGEN SINTER *at 1350C, strength of nickel tripled. Although density was increased only 4%, oxide was reduced . . .*

Sintering Treatment (1350° C)	Bursting Strength (psi)	Density (% theo.)
15 min.	23,800	96.1
30 min.	24,150	97.1
60 min.	30,000	97.6
480 min.	34,000	98.0

MOLYBDENUM DEPOSIT *strength was increased when a nickel liquid phase increased density. However, 6.0% nickel gave 100% density but set up brittle intergranular delta phase; lowered strength . . .*

Composition	Sintering Treatment (1375° C)	Bursting Strength (psi)	Density (% theo.)
0.25 % Ni	1 hr	13,250	93.8
0.78 % Ni	1 hr	21,000	95.1
6.0 % Ni	1 hr	8000	100.0

FOR NICKEL, *bursting strength increases as the theoretical density; both are inversely proportional to amount of oxide . . .*

% Oxygen	Bursting Strength (psi)	Density (% theo.)
0.46	9400	91.8
0.44	10,600	92.7
0.32	11,100	93.6

AS-SPRAYED STRENGTH *of Vitallium and Hastelloy "C" deposits was fairly good. These were sprayed from laboratory-made rod . . .*

Metal	Bursting Strength (psi)
Vitallium	20,000
Hastelloy C	20,100
CM-469 (60% Cr, 25% Mo, 15% Fe)	9200

STRENGTH *of Vitallium and Hastelloy C is doubled with 1-hr sinter at 1300-1325C; strength of CM-469 gains 50% . . .*

Metal	Sintering Treatment	Bursting Strength (psi)	Density (% theo.)
Vitallium	1 hr @ 1325 C	42,000	100
Hastelloy C	1 hr @ 1300 C	44,000	100
CM-469	1 hr @ 1350 C	14,030	92.4

sintering time was increased by 15-min. intervals, strength also increased. Optimum bursting strength was achieved with a 45-min. sinter at 1350C. This was 17,500 psi. Additional sintering decreased strength, even though density increased. Major reduction of oxide and elimination of pores occurred in first 15 min. at temperature. All materials were sintered, with no evidence of cracking or distortion.

Nickel samples, sintered as above, showed a *threefold* increase in strength after only 1 hr at 1350-C. Although elongation wasn't measured, subsequent examination of the fractured piece showed considerable increase in ductility.

Strength measurements were also obtained for cold-drawn nickel and spun molybdenum tubing, following a 1-hr hydrogen anneal at 1350C. The solid nickel tubes yielded an average bursting strength of 36,000 psi, only slightly greater than that obtained with sintered deposits. Tubes spun from molybdenum only failed at stresses greater than 54,000 psi. The effect of excessive residual oxygen on the bursting strength of sprayed molybdenum is thus clearly seen.

Sintering of sprayed molybdenum in the presence of a liquid phase gave additional improvement. The liquid phase can be introduced by adding a lower-melting-point material, in this case nickel, to the wire or rod before spraying. It can also be sprayed with a separate gun simultaneously with the primary material. The most successful method, again in this case, was to paint or spray successive coatings of a solution of very fine nickel powder or nickel salts suspended in alcohol on the molybdenum deposit. The porous deposit absorbed the fine suspension and distributed the nickel throughout the spray coat. However, there is less likelihood of even distribution by this method when sprayed deposits are much heavier.

The maximum solubility of solid nickel in molybdenum is only 0.9% nickel. Above this value an intermetallic compound of extreme brittleness is formed. Hence, the amount of nickel added was held below this value. Specimens were sintered for 1 hr, in hydrogen, at 1375C, the lowest temperature at which liquid phase can be formed. The full hour at temperature assured complete reduction and densification. Additions of 0.25 and 0.78% nickel produced strength values greater than sprayed and sintered molybdenum, but theoretical density was not achieved. This was puzzling, until metallographic examination showed that such small quantities of nickel were insufficient to fill completely all of the interparticle spaces. Upon adding 6% nickel, theoretical density was obtained and this indica-

tion was substantiated. Typical of most liquid-phase sintered alloys, rounded grains of the solid constituent are surrounded by a matrix of the initially liquefied phase. In spite of high density, the 6% nickel specimen had every poor hydrostatic bursting strength because of the presence of the brittle delta phase, or intermetallic compound.

Vitallium and Hastelloy C were sintered at a temperature between the liquid and solid states to permit formation of a liquid phase. Both alloys were extensively decarburized during sintering in a hydrogen atmosphere.

Because of the extremely high solidus of the CM-469 alloy, above 1600C, the alloy could not be sintered in the presence of a liquid phase with the available equipment Hence, the strength specimen was sintered at a lower temperature. Densification of such an alloy can possibly be achieved through addition of lower melting-point materials without seriously affecting the alloy properties. Additions of small amounts of sprayed iron, for example, provide formation of a liquid phase at a temperature well below the solidus of the alloy. As diffusion of the liquid proceeds, alloying eventually occurs, and the liquid phase disappears. But, before this happens, appreciable densification is obtained.

Densification of sprayed high-melting-point metal deposits by subsequent heating with oxyacetylene or atomic-hydrogen arc flames is possible, but seldom practical. Oxide removal is more difficult and the deposit frequently cracks. Flame sintering was more successful when a flux was simultaneously sprayed with the metal or when boron was alloyed with the spray coat. Nevertheless, the mechanical properties achieved do not compare favorably with those reported in this discussion.

Simultaneous spraying and sintering in air was also tried, using various commercial spray guns, as well as our own development. Both metal powders and powder plus flux combinations were used. For hard-facing and coating this method was fairly successful, but its usefulness was very limited for making hollow bodies of significant dimensions.

Although the parts described here are of test size only, large parts can be produced by the same method. However, sintering a larger body in an electrical resistance furnace is difficult. Use of a quartz tube furnace, in which work is heated by induction, is much better. One design of furnace holds the work stationary while an induction coil moves axially along it. Induction sintering, in this case, is more rapid and economical than resistance-furnace sintering. Also, it can be done in vacuum, as well as with reducing or inert gases.

For many applications, the intergranular delta phase is too brittle when 6% nickel is used. Smaller amounts of nickel may provide complete densification, but still cause some brittleness. This condition sometimes can be avoided by using cobalt or iron, which likewise form low-melting phases. Molybdenum deposits can be strengthened by using a molybdenum-tungsten spray coat made from alloy wire in place of pure molybdenum. Tungsten in solid wire form could not be sprayed with available equipment.

TITANIUM GROUND BY LOCKHEED

WHEEL LOADING, poor surface finish, and very high wheel loss have made titanium an extremely poor material to grind. Some recent research by Lockheed Aircraft Corp. concludes:

1. Satisfactory surface finish can be obtained.
2. Material removal must be kept to a minimum.
3. Thread grinding is practical.

As all tests were run on 5% Cr, 3% Al, Mallory titanium alloy, caution should be used in applying the following results to other alloys.

Centerless grinding on a Cincinnati No. 2 machine showed the best wheel grade to be a Carborundum C 54-04-VGC. A mixed coolant was used which contained: 25% Codol from Los Angeles Oil and Grease Co, 25% Solcut from E F Houghton & Co., and 50% water. Stock removal should never be more than 0.002 in. per cut. By following this method, a 10-microinch finish was readily obtained, and, in general, grinding was comparable to Colmonoy.

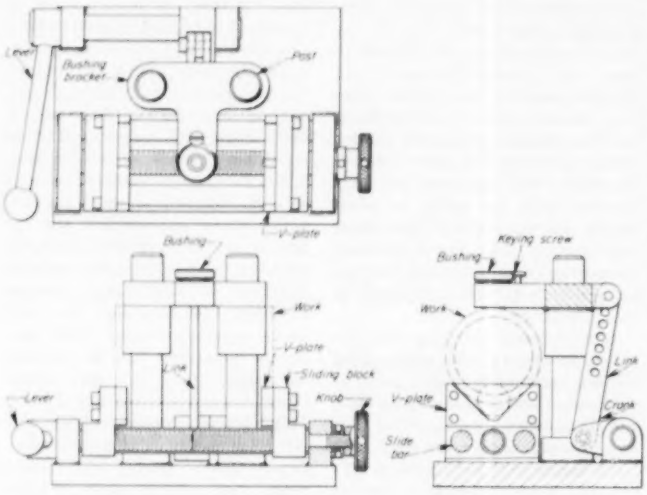
Cylindrical grinding on a Norton 6x30 machine was found most suitable with a Carborundum C 60-P wheel and coolant composed of 1 part Antisep soluble oil (E F Houghton & Co) to 70 parts of water. At very slow feed and light depth of grind, a 10-mu in. finish was obtained. Grinding action was similar to that when grinding Carboloy.

Surface grinding on a No. 3M Abrasive machine, using a Norton 3760 L wheel, and the same coolant as for cylindrical grinding, produced a 12-mu in. at approximately 0.0005 in. per cut slow table feed. Material ground like Colmoloy. Wheel wear is rapid.

Thread grinding on a No. 636 Jones & Lamson machine showed the best wheel to be a Macklin 100 W2 B7, dressed to 12 tpi. Stuart's Super Kool 81X Grinding Oil was used. Satisfactory threads were produced with a stock removal of 0.010 in. per cut. Material acted like high-carbon, high-chrome steel hardened to R_c 65.

Titanium can be ground satisfactorily, but these tests indicate that wheel surface speeds must be *reduced* to 3000 or 3500 sfpm rather than the standard 5000 to 7000 sfpm. When these lower speeds are used, grinding action will be similar to that when grinding hard chrome plate. Stock removal, rather than good surface finish, causes the greatest difficulty. The lower surface speeds seem to improve the rate of stock removal.

Practical Ideas



Expanding Drill Jig Takes Any Bushing Size

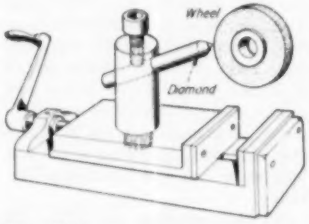
FOR A SERIES of bronze bearing bushings we were making, we had to have a jig that would take a number of bushings of different length, but would locate the hole through the bushing wall exactly in the center of the bushing. To do this, we made an expanding workholder combined with a drill jig.

To center the bushings exactly, two V-notched jaws were mounted on a combination clamping screw that was right-hand on the left side and left-hand on the right side. A setting knob at the right side of the fixture allowed rotating the screw to retract or pull together the jaws, which were guided by two bars.

At the rear of the baseplate, a bracket mounted a crank that was linked to the drill-bushing clamp. A side lever allowed exerting pressure to hold the work firmly when drilling.

The clamp arm was drilled to slide on two vertical posts, which insured accuracy of the drill-hole location. Adjustments to the length of the link, to suit different diameters of work, were simple because the link was pinned to the clamp piece, and several holes in the link could be used alternately.

Adjustments to the clamping screw were not often required, but shims and washers could be inserted between bearing surfaces of the brackets if necessary. *Tom Brown, Perivale, England.*



Vise Slide Traverses Wheel Dresser

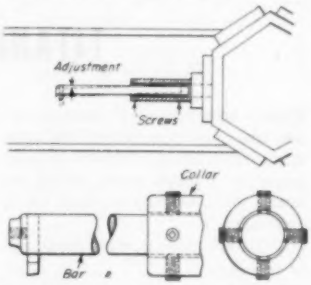
FOR QUICK WHEEL DRESSING we assemble a toolpost-like bar into a tapped hole in the top of one of our machine vises, add a diamond holder, and set the vise on the machine tabe.

The post mounts on the vise slide, so the dresser can be accurately traversed, and also tightly held to prevent extra motion. If the diamond is adjusted to the same height as the center of the grinding-wheel spindle, dressing can be done in a horizontal plane. The grinding wheel can be easily dressed to any angle, V-notch, or sharp edge. *C. H. Drexler, Rochester, N. Y.*

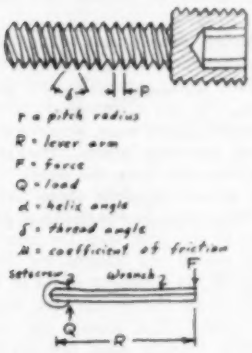
Adjustable Boring Bar Swivels on Setscrews

BORES of varying diameters, within a fairly small range, can be easily handled by this tool without extensive setup changes. The boring bar itself is held in an elongated collar which fits into a turret.

Two sets of large setscrews are the only clamping device. Four are in a ring at the head of the collar, and four ring the collar at the rear. The screws in the vertical plane will require little adjustment, but those in the horizontal plane will be adjusted to shift the end of the boring bar for large or small diameters.



If the collar is large enough, considerable adjustment will be possible. It is important for accuracy and to limit slipping that might damage the toolbit that all screws be tight when boring is done. *J. C. Salinas, Corpus Christi, Texas.*



Differential Threads — Discussion

(The original problem was to remove a cover plate from a machine frame as easily as possible; therefore a setscrew was assembled to the frame, and the cover plate was drilled and tapped to assemble against the frame by means of a thread cut on the head of the screw. As the setscrew was turned out of the frame with a wrench, the cover was forced away from the frame, and did not have to be pulled by hand.—Ed.)

I agree with Mr. P. Grodzinski's explanation of differential screws (*AM* Oct 15 '51, p 160) in theory, but would like to point out that the difference between a left-hand thread and a right-hand thread on the head of the screw has little effect on the force required to pull the screw out. For the purpose of these calculations, assume the coefficient of friction to be 0.15, and thread angle δ to be 60°.

For example, take a screw with an 11-tpi, right-hand thread and cut the head to 16 tpi, left-hand. The screw has an OD of ⅝ in., and the head is ⅞ in. Therefore, r is 0.283, p is 0.090, and α is 2° 56′ (by calculation).

$$\text{Tan } \beta \text{ (friction angle)} = \frac{\mu}{\text{Cos } \frac{\delta}{2}} = \frac{0.15}{0.866} = 0.1733$$

$$\beta = 9°50'$$

$$Q = \frac{FR}{\text{Tan}(\alpha+\beta)\gamma + \text{Tan}(\alpha'+\beta')\gamma'} = \frac{20 \times 10}{0.2264 \times 0.283 + 0.198 \times 0.417}$$

= 1365 lb. (The prime values are for the head.)

Now assume the same screw, but with the thread on the head cut right-hand:

$$Q = \frac{FR}{\text{Tan}(\alpha+\beta)\gamma + \text{Tan}(\alpha'-\beta')\gamma'} = \frac{20 \times 10}{0.2264 \times 0.283 + 0.149 \times 0.417}$$

= 1585 lb.

Here the force is almost the same, but the threads on the screw-head force the cover plate out much more slowly because both threads are right-hand. Efficiency of a given screw is determined by both the coefficient of friction and the helix angle, but for threads with small helix angles, like U.S. Standard threads, the coefficient of friction is much the more important factor. Therefore, in the case of the cover plate, you might as well have one thread right-hand, and the other left-hand because they will work much faster this way, and the difference in force required to work the screw is unimportant. *A. Vetsch, Steffisburgh Station, Switzerland.*

Metric Threads Cut Without Special Gears

IT IS POSSIBLE to cut standard metric leads from 0.5 to 3.5 mm on a lathe with an 8-pitch leadscrew and a standard set of loose change gears. The error will be 0.015 mm or 0.0006 in. for all leads. No special equipment, with the exception of a possible stud for mounting intermediate gears, is needed.

By using a 52-tooth gear driving a 44-tooth gear on the leadscrew, a lead of 3.75227 mm is obtained. This is close enough to 3.75 mm to be practical. The two gears, arranged in compound trains of four gears, and with a possible idler, can be employed for a number of metric leads. For instance, a 1-mm lead is 3.75 mm finer than the direct 52-44 gearing. Thus:

$$\frac{52}{44} \times \frac{1}{3.75} = \frac{52}{44} \times \frac{4}{15}$$

which, transposed into available gears, becomes 16 on stud driving $\frac{44}{52}$ on intermediate, and 60 on the leadscrew.

When cutting, do not use the threading dial, but keep the split nut closed. The spindle is reversed for each successive cut.

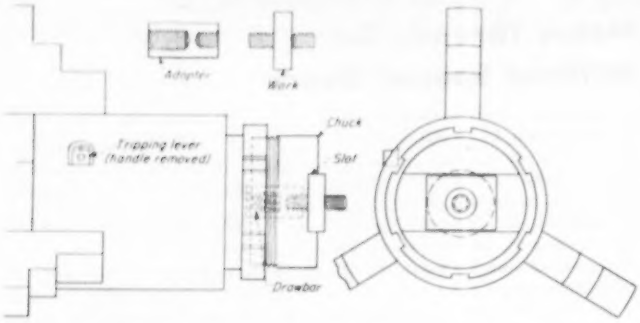
Table No. 1 lists gearing for standard lathes obtainable with compound gearing, and is supplemented by Table No. 2, which gives the two missing leads in the series by double compound gearing. All leads were set up and run on a 9-in. South Bend lathe. *Adolph Harvest, Humber Bay, Ont.*

Table No. 1 8-pitch Leadscrew

Lead (mm)	0.75	1	1.25	1.5	2	2.5	3	3.5
Gear on stud	16	16	16	24	32	40	48	56
Gear on leadscrew	80	60	48	60	60	60	60	60

Table No. 2 8-pitch Leadscrew

Lead (mm)	Gear on stud	1st Intermediate DRIVEN	1st Intermediate DRIVING	2nd Intermediate DRIVEN	2nd Intermediate DRIVING	Gear on Leadscrew
0.5	25	44	52	54	18	60
1.75	56	44	52	18	54	40



Modified Tapping Head Chucks Odd Pieces

THE PRINCIPLE of a collapsing tapping head is based on a system of imparting a push-pull action to a drawbar, which expands or contracts the dies. This can be altered to pull a workpiece of odd, rectangular shape into a nesting chuck, and to eject it after turning has been done.

The chuck is made by slotting a piece of stock across to fit the work. Then it replaces the tapping head on the operating body. The tripping lever is adapted so it can be removed after the work is inserted, to prevent it from whipping around the chuck as the work rotates.

A stub screw on the workpiece allowed us to cut a short adapter with tapped holes at both ends, which was added to the drawbar. Work was inserted by giving it a few short turns so the screw enters the adapter, lining up the body so it matches the slot across the chuck, and then operating the tripping lever.

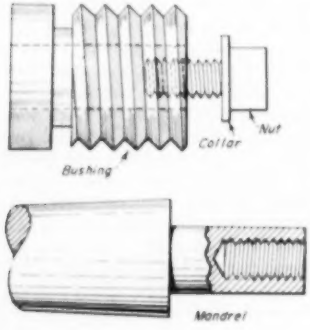
Allan Clarke, Rochdale, England.

Plastic Threads Cut by Grinding

WE HAD AN ORDER for a thousand threaded bushings made of Textolite material (impregnated plastic), so we tried cutting the threads with a single-point tool. It didn't work because the stock broke off at the ends of the thread.

But we then tried grinding the threads with a toolpost grinder, and it did work. The complete thread could be cut in one pass with the leadscrew powering the carriage.

The work was mounted on a mandrel, held by a washer and screw into the outer end of the mandrel. *John J. O. Wril, Methuen, Mass.*



Grinding Wheel on Lathe Trims Up Chuck Jaws

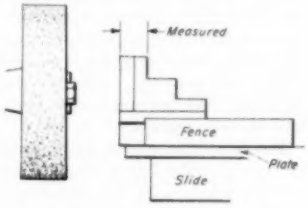
JAWS on self-centering chucks usually become worn long before the scroll is affected, and unless all jaws are equally hard, one jaw will be found to have worn more than the others. The following method is simpler than holding the jaws in compression with a ring, and seems to correct this wear just as well:

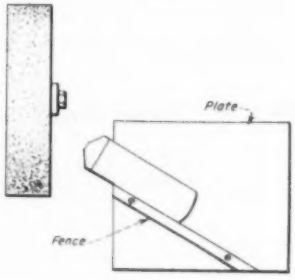
Mount a thick plate on the lathe topslide, and clamp a fence (or guide) to it, parallel to the lathe axis. On an arbor held in the tapered spindle nose, mount a new plain grinding wheel. The jaws are removed from the chuck, and are ground to clean them.

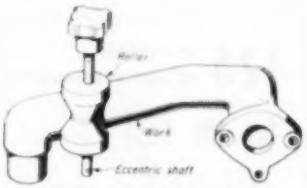
Next, measure the depth of each jaw at the first step (or notch), and record the dimensions. Now regrind the clamping edges of the jaws until the depths are about the same. This should be done gently, holding each jaw on the plate, against the guide, by hand.

Reassemble the chuck, and grip a piece of bar stock in it. Check concentricity with a dial indicator, both next to the jaws, and five or six in. out from them. With a few tries, the jaws should run the work true within a few thousandths. Finally, remove a little jaw material with a honing stone until the bar will run dead center and true.

The gripping surfaces are now flat, not concave; but we have found this to be of little importance. If you want to, you can shift the guide to 45° or 60° and grind off the corners of each jaw to produce a narrow (1/16-in.) clamping surface. *Ian J. Peacock, Ainstable, England.*



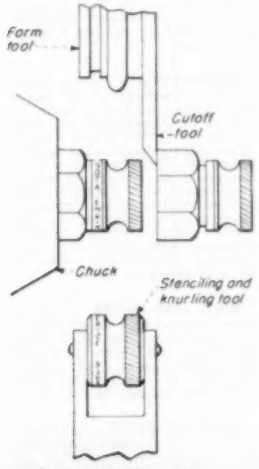




Off-Center V-Roller Clamps Odd-Shaped Part

ENGINE-OUTLET ELBOWS we make are long and clumsy, yet they must be drilled accurately. The setup we have evolved is in a large, box-like fixture, where adjustable screws are set to locate most of the sides of the part. For final clamping we utilize a V-section roller that is drilled eccentrically so it will tighten on the part as its spindle is rotated.

The V-section roller is drilled off-center, then assembled with a pin or setscrew onto a shaft that can be rotated by means of a knob or lever outside the body of the fixture. Action is fast, and the roller centers the part automatically. *Jack Jensen, Quincy, Ill.*



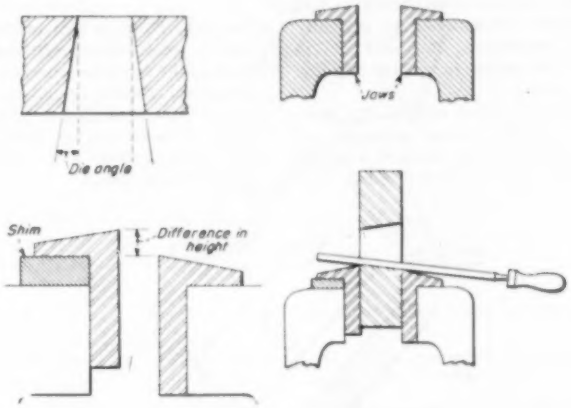
Stenciling Attachment Works on Screw Machine

PAPER WEIGHTS, made from 1-in., SAE-1020 hex stock, were stenciled and knurled on the screw machine with a tool that is somewhat out of the ordinary. Both the stenciled and knurled diameters were the same, which enabled us to use a single knurling roll to do the work.

On a single-spindle Cleveland automatic, a front slide carried the hardened knurling tool in a yoke holder. The rear slide carried the cutoff tool.

Pressure of the slide against the work forced the straight knurling section of the tool to rotate, which made the stenciling section cut, too. Action is just like gearing.

This same technique can be applied when serial numbers or part numbers are to be applied. If the knurl is not needed on the part, the roll can be made so the knurl will appear on a surface that is later to be turned off. As long as the two diameters—stencil and knurl—are the same, the roller tool will work. *D. A. Rogers, Minneapolis, Minn.*



Die-Filing Jaws Hold Taper Accuracy

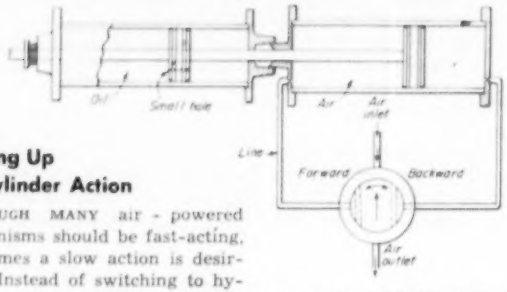
FILING SMALL-ANGLE TAPERS in the sides of punches and die openings is difficult enough, but is worse if the angles are under 1° and if high accuracy is required. To simplify this job, we make supplementary vise jaws that will control the filing angle.

The jaws are made of tool steel, hardened and ground. The jaw tops are slanted so the file will touch only the edges closest to the work. They are installed in the vise, the work is locked between them, and we are ready to file down until the file touches *both* jaw tips.

To control the angle, shims are placed under the flanges of one or both auxiliary jaws. We calculate the difference in height required by considering the angle wanted and the thickness of workpiece. In fact, we have worked out a table for easy reference:

Work Thickness In.	Draft Angle Deg			
	¼	½	¾	1
½	.0022	.0044	.0066	.0087
⅝	.0027	.0055	.0082	.0109
¾	.0033	.0066	.0098	.0131
⅞	.0038	.0076	.0114	.0153
1	.0044	.0087	.0131	.0175
1⅛	.0049	.0098	.0149	.0196
1¼	.0055	.0109	.0164	.0218
1⅜	.0060	.0120	.0180	.0240
1½	.0066	.0131	.0196	.0262
2	.0087	.0175	.0262	.0349

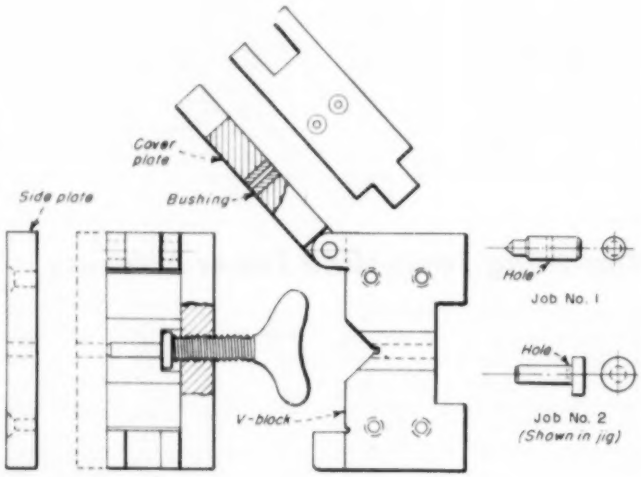
When the work is clamped in the vise, one of the auxiliary jaws is raised above the other by the amount indicated in the table, depending upon thickness of work and the angle of draft. Then we file until the file touches both jaw tips. *Federico Strasser, Santiago de Chile.*



Slowing Up Air-Cylinder Action

ALTHOUGH MANY air - powered mechanisms should be fast-acting, sometimes a slow action is desirable. Instead of switching to hydraulic power when it is really not convenient, this sort of rig can be made to utilize air-line pressure.

The air valve admits line pressure to the cylinder as usual, but connected to the piston is a second piston in a cylinder filled with heavy oil. Through this piston is drilled a small hole, depending in size upon the speed required of the mechanism. Having no outlet, the oil must pass through this hole as the air cylinder works; therefore action must be slow. *J. C. Salinas, Corpus Christi, Texas.*



Double-Duty Jig For Two Drill Jobs

ONE CAST-IRON V-BLOCK, two side plates, and one hinged cover plate that carries drill bushings are all that are necessary for a jig that sets up two different workpieces for the drilling of a hole in each.

The two components are about the same diameter at the sections that lie in the V, but are not exactly equal. When job No. 1 is run, the work is inserted so the pointed tip enters the hole in the left-hand side plate, and the wing-screw is tightened against its other end. For drilling, the bushing nearest the left-hand side plate is utilized.

For job No. 2, the work is set in the V with the shoulder against the recessed face in the right side of the V-block, and the screw is tightened. The other bush is used.

For highest accuracy, the contact surfaces between plates and the V-block can be ground. *C. Y. Lee, Taiwan, Formosa.*

$25 *In addition to regular payment*

for the best

PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards, and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N.Y.

143rd Winner:

(For December 10 issue)

Jacks Harris

Emergency LH Tap

ROUND TABLE

Stump Speech

"Election ain't until November, but you'd think it was tomorrow, the way some of the boys are carrying on, Al. Several of the boys have been wearing "Ike" buttons, and now Murphy, the miller hand, has stuck up a Taft poster. That's really started the arguments."

"Don't tell me you've got some Republicans in the toolroom, Ed! Particularly a Taft man—he must be a retired capitalist or a leftover from 1928! What about the Democrats?"

"They don't know who they're for, yet—they haven't been told. But I don't like that stuff around the shop. It's bad enough to get into knockdown-dragout fights outside; why do it on company time?"

"Ed, sometimes I think you're not human. They're always going to talk and argue about something, and politics is a good thing to have some views on. And they do keep on working. After all, in a lot of countries today, nobody dares to have any opinions but favorable ones—and they'd better be favorable to the official ticket."

"I know, Al. I'm not objecting to politics, and I'm glad we can still have opinions. But why do we have to prove we've got 'em every morning and noon for a half hour of company time? We've got work to do. And, as you brought the subject up—a lot of the work is defending the right to have more than one party. A little less gab and a lot more work would help save it."

"I'm not arguing that point. But if it wasn't politics, Ed, it would be women, or what they did the night before, or which car is best. Any man has to blow off some steam when he's around other men, you know that."

"Look, Al: When you were still in rompers and I was finishing my time, I had ideas, too. But we didn't talk about 'em in the shop; we weren't allowed to. Any talking we did about anything except work we had to do when the boss turned his back."

"Don't you think it's a lot better now, Ed? Maybe it's time there was freedom of speech in the shop, too. Remember that instructions from the boss to vote for Hoover made a lot of votes for Roosevelt in 1932."

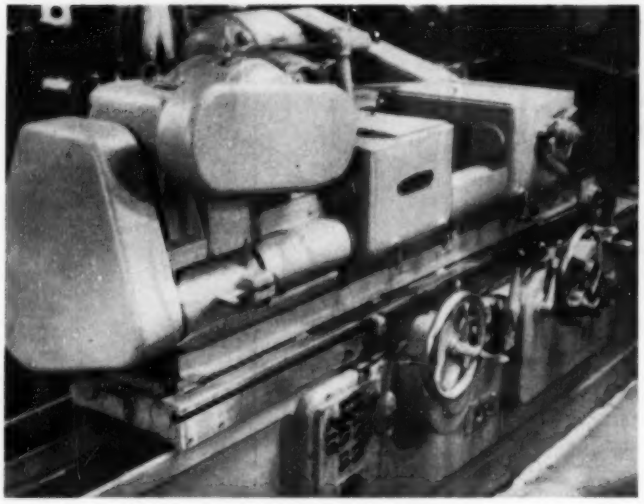
"Maybe so. But no boss is telling 'em how to vote now. It's just that freedom of speech to some guys is the right to gab like women over a back fence. Give 'em an inch and they talk a mile. Even the Democrats argue about Stassen, Taft, and Eisenhower. What business is it of theirs? They won't vote for a Republican anyhow."

"Some of 'em might, Ed. When it comes to politics, every man thinks he's an authority as well as a silver-tongued orator. He believes he can swing votes just by the power of his voice. It's one of the few things most men think they're good at—and better at than their wives."

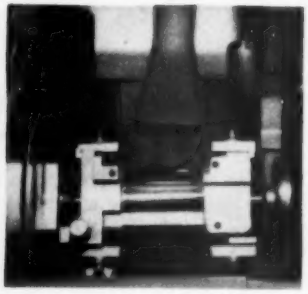
"Don't pull all the stops, Al; you'll have me sobbing. Stick to the point: It's still a good idea to do a day's work for a day's pay, not just talk about it."

ARE "TALK-BREAKS" *essential for morale? Has the greater freedom to talk in the shop been abused? Have employers missed the boat in not making their own political preferences known? Your ideas and opinions on this subject will interest others. Discussions of earlier topics appear on later pages.*

New Shop Equipment



Two housings on Type CTU table are connected by single camshaft; but contain identical, synchronized cam mechanisms and work arbors



Fixture is swung on ball centers. Right-hand center is retracted by lever to allow loading

Stator blade has compound curve. Fairing lines (**dashed**) are straight, not parallel

Jet-Blade Grinder Forms Compound Airfoils

One of the first special machines specifically designed for work on jet-engine components is the Norton compound-contour jet-blade grinder. It is equipped with cam-controlled stub arbors, special workholders for two or three jet-engine blades, and automatic hydraulic wheel dressing.

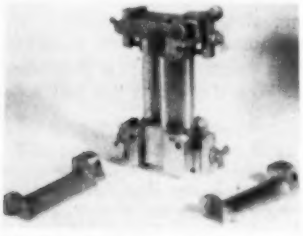
Blades are held on a fixture between synchronously driven work arbors in two heads on the machine table. The fixture may position two or three blades, depending on the sharpness of the outside curve required on the blades.

Wheel speed is 6500 sfpm, and fixture rotation is at 15 rpm. These standards were determined by test to be most practical for most blade materials. Taking approximately 25 thousandths off forged blades, the machine handles 38 pieces per hour. For extra cooling, liquid can be pumped through the work arbors and into the fixture, where it spreads centrifugally onto the work.

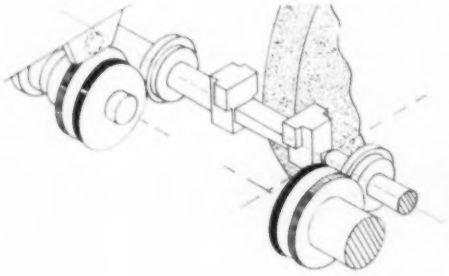
Cutting is done in one plunge grind. Cam changing for different blades is quickly accomplished because all cams are on the same shaft in each head.

Because airfoil contours are not true circles but are gradually changing radii along a cross-section of the blades, work-surface distance from the wheel must gradually change as the blade passes the wheel. One set of cams controls this motion, moving the work arbors forward or backward through cycles synchronized with blade location on the fixture and fixture position relative to the wheel. For fairing-angle change, one arbor is tilted up and the other down by the second set of cams as the trailing edge of each blade passes the wheel.

Norton Company, Worcester 6, Mass.

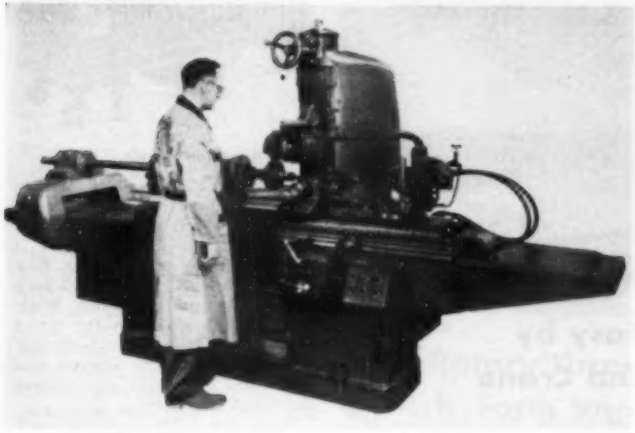


Preliminary fixture locates blades on previously finished inside curves, but will be simplified for production models



Black cams move work arbors in and out to allow for change in radius across blade. **Gray cams** tilt arbors to allow for change in slant of fairing lines

Materials and Parts



Grinder Does High-Precision Form Grinding of Helical Gears

The Red Ring Helical Gear Grinder Model SGP, while designed primarily for the high precision form grinding of helical gears, may also be used for spur gears and splines. The machine uses the lead-bar principle with certain refinements for the maintenance of the true helix angle or lead.

The split saddle nut through which the lead bar reciprocates is rigidly supported by a bridge housing bolted to the machine base. The column of the helical grinder is mounted on the machine base and is located by two circular slots in order to position the plane of the wheel for the desired helix angle of the work. It can easily be moved to the desired radial position by means of a graduated scale and a semicircular chain rack and pinion, controlled by a hand crank. When positioned it is locked securely to the machine base.

Automatic index mechanism is an integral part of the prevision live center headstock, mounted at the left end of the table. Indexing is entirely mechanical and is actuated by the motion of the lead bar. When grinding spur gears the lead bar is easily disconnected and indexing can be done manually by throwing a lever at left side of the head.

The housing carrying the grinding-wheel spindle is moved vertically in both directions by an elevating screw which is operated by a handwheel on the column.

A graduated slip drum at the upper end of the elevating screw facilitates the accurate vertical setting of the head. The wheel spindle may be adjusted axially and wheel speed may be varied by changing pulleys.

These grinders are equipped with precision wheel dressers for any tooth form desired. These include the involute, root diameter, full root radius, angle and root fillet dressers.

The dresser head carries two horizontal and parallel spindles, each free to rotate on its own axis and pivoted on a rocker shaft beneath it, thus giving two rotary motions.

Each spindle carries at one end a diamond-tipped dressing tool and at the other a corresponding follower point. The follower points bear on the sides of a hard, accurately ground master tooth form. In operation the follower points trace along the contour of the master tooth form, thereby causing the diamond points at the opposite ends of the spindles to move in similar paths. These diamond points being in contact with the grinding wheel dress it to the contour of the master tooth form.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

... INCLUDING

Combination platform truck and crane handles 4000-lb pallets and 2000-lb hoist loads—makes maintenance easy ..... page 184

Rotary draw former stretch-forms vanadium alloys used in jet engines ..... page 185

Hydraulic-hose-coupling machine does a complete assembly and swaging job ..... page 186

Double-action toggle press features quick advance and return speeds ..... page 187

Universal jig and fixture system is built up from standardized elements ..... page 188

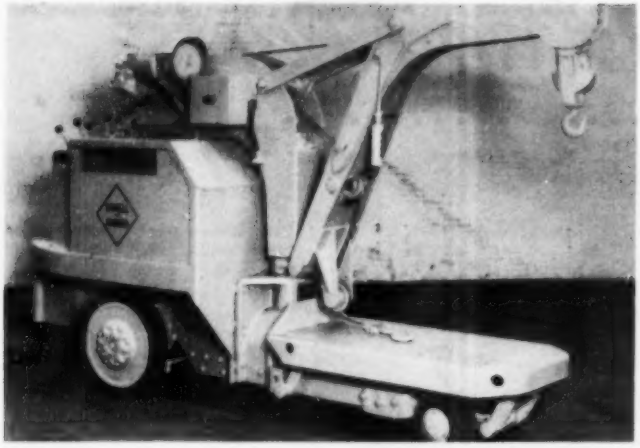
Solenoid-operated brake has two independent shoes and two solenoids—releasing one solenoid for use as a spare ..... page 189

NEW BULLETINS for Your Shop Library, including a 60-page manual on safe work practises in the maintenance and construction fields ..... pages 216A, 216B

... and in March 17

Hydraulic press used for hydrostatic testing bazooka rocket bodies. Rate is 600 per hr.

Cylindrical grinder in plain or semi-automatic models has a graduated wheel-feed handwheel.



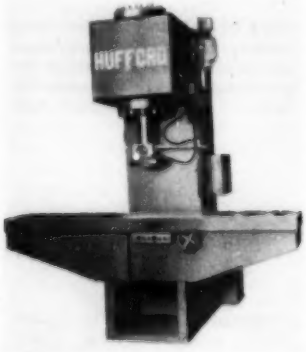
Maintenance Made Easy by Combination Truck and Crane

In addition to the standard 4000-lb capacity self-loading platform which is designed to lift and transport skids, the truck is equipped with a powered winch for pulling heavy loads on or off the platform. The boom swivels 180° and permits hoisting loads weighing up to 2000 lb.

Power is supplied to the individual motors which power the drive, platform lift, winch, and hook by an electric storage battery or gas-electric unit. The winch, platform, and hook can be controlled from both the operator's position and the load end using a remote control switch located on the boom. Two-wheel drive, four-wheel steer is provided. All motors drive through worm-gear reduction units.

The platform lift operates on a three-link rocking mechanism protected from overloading with a safety link.

The Elwell-Parker Electric Co., Cleveland, Ohio.

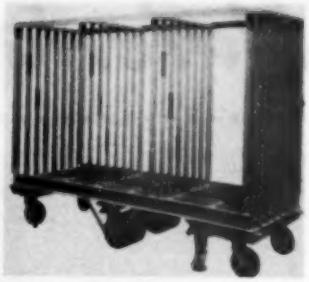


Overbending Prevented on Hufford Straightening Press

An automatic stroke limiter on this hydraulic straightening press protects against overbending. A vertical shipper rod attached to the side of the frame is linked to a hand lever which serves as a manual control. In shifting this rod up or down, fluid volume from the variable-volume pump is increased or decreased in proportion to level displacement. A stop, attached to the shipper rod, is engaged by the ram in its descent, gradually bringing hydraulic volume to zero and halting the ram automatically at any position.

For rapid stroke alterations, a special attachment is furnished. In this, a threaded shipper rod is rotated by a reversible motor controlled by pushbuttons. The stop, being threaded to this leadscrew, is thus automatically shifted up or down as rotation occurs. Final micrometer settings are made by means of a handwheel connected to the screw by a gear box. One handwheel revolution equals 0.125 in. of ram travel. An automatic counter indicates ram extension to within 0.010 in. from the starting position and a dial gage shows applied force from 0 to 150 tons.

Hufford Machine Works, Inc., El Segundo, Calif.



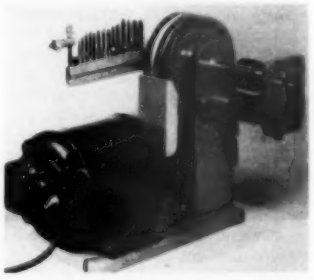
Sheet-Handling Truck

This truck is designed to operate over wood-block or concrete floors. It can easily and quietly be moved by hand or hauled by a tractor.

While loading or unloading, floor locks on each side of the truck keep it stationary and in position. Wide-faced rubber wheels in the center cushion the load, prevent damage and lessen wear. The wheeels also allow easy movement over uneven and rough floors.

There are seven openings, each 4⅜ in. wide. The deck portion of the truck is open and fitted with short rollers on ball bearings, for easy entrance and removal of sheets. Capacity of the unit is 6,000 lb.

Market Forge Co., Everett, Mass.



Field Hand-Threading Machine Has Ball-Bearing Hollow Spindle

The Field Sesi-Threader is designed to cap holes and cut threads accurately and speedily by hand. With simple holding fixtures screwed to the workplate, castings, stampings, moldings, and machine pieces can be threaded on a production basis. Using a chuck adapter and die; rods, tubes, wires, and studs can be threaded. It occupies only 16x18 in. bench space.

The new model EBB has a ball-bearing hollow spindle and a No. 3A Jacobs chuck. It has a tap and die capacity of 10/24 to ⅜-16 with 1/3 hp.

Herb M. Field, Portland 12, Oregon

Tracer-Lathe Toolholder Can Cut in Two Directions

This toolholder takes 55° diamond-shaped solid Wessonmetal inserts, which are able to cut in either direction. Clearance is provided on both sides of the diamond insert to permit this multi-cutting action.

The carbide insert is held by a tempered steel band, the only part of the holder subjected to wear. The tool provides a maximum cutting edge clearance of 35° in straight shoulder turning, has two cutting edges, and will cut from right to left or left to right.

The insert can be turned end for end and give the user two new cutting edges, making a total of four cutting edges for each insert. The toolholders can be used on either, or simultaneously both sides of the work. They can also be locked in position right side up or upside down. When used in the upright position the insert, when adjusted flush with the faced-off top surface, is centered automatically. Locking, adjusting, and changing of inserts is done by adjusting screw on top of the holder.

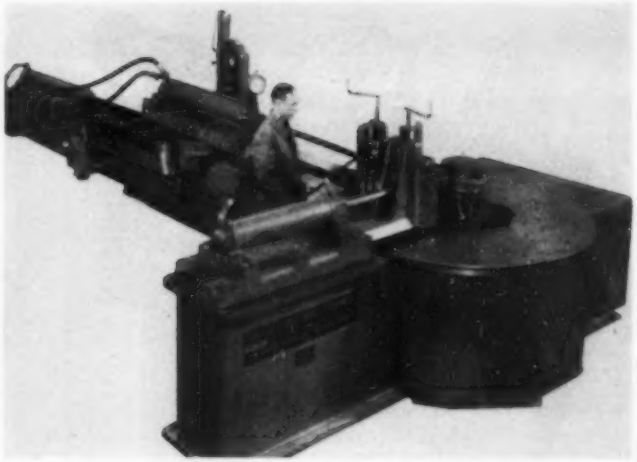
Wesson Company, Ferndale, Mich.

Rough Grind, Finish Grind, and Notch, All with the Same Wheel

Designed for use on right-angle portable grinders, this wheel is made of carded web material impregnated with abrasive grain. It is light, possesses good strength, and is sufficiently flexible to permit blending of contours. Known as the BFR, it will be used to smooth down welds, blend surfaces on contours, and notch risers in castings.

Unusual strength is achieved by a safety web built in the back of the wheel.

Norton Co., Worcester 6, Mass.



Bath Rotary Draw Former Will Stretch-Form Vanadium Alloys

Known as the Rotary Draw Former, this tool has proved particularly useful in stretch-forming Haynes-Stellite and various vanadium alloys used in the afterburners and combustion chambers of jet engines. It is also said to be able to produce a number of other jet-engine parts which have not been readily produced by other methods.

It consists of a power-driven rotary steel table similar to a vertical boring mill and a horizontal bed on which is mounted a hydraulically-movable carriage. On the carriage is mounted a swivellable ram, like a large shaper, operated by a hydraulic cylinder and the whole element is mounted on roller bearings.

One or two stretch jaws are adjustably mounted on the ram. The other jaw is mounted on the rotating table and the work is stretched between them. The work is previously shaped roughly to the required cross section as are also the gripping jaws. The metal is then stretched between the jaws, and this pressure is automatically held constant during the forming operation. The table is then revolved. This causes the metal to be stretched or drawn over the outer diameters of the shape mounted upon the table, the amount of draw becoming progressively less toward the inner diameter where very little elongation may be required.

Simultaneously, to assist the process, and to assure accuracy in cross section, a side head applies hydraulic pressure through a hard-bronze shoe, wiping the metal onto the revolving die as the table revolves.

Rings up to 48 in. dia have been drawn with a ten-thousandths tolerance for variation in cross-section or circumference.

In the final operation the rings are held in a welding fixture and automatically welded with atomic hydrogen, the cooling being so rapid that distortion in the finished ring is held to a minimum. No restretch operation is required.

The rotary draw formers are produced in six sizes: 12½, 25, 35, 50, 75 and 100 ton.

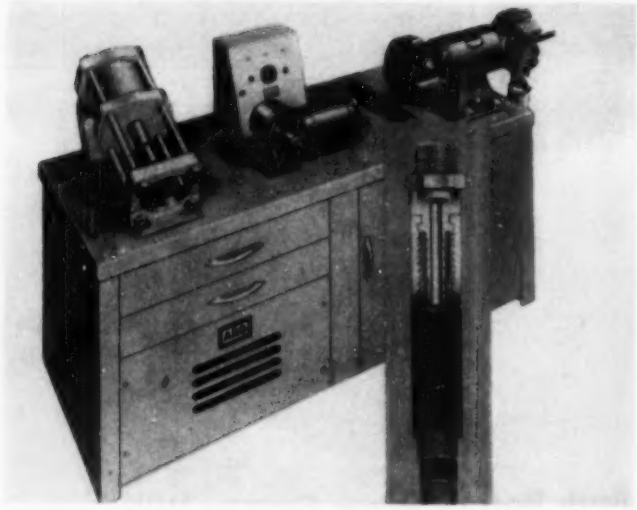
Cyril Bath Company's standard Contour Former can be converted into a rotary draw former by the addition of appropriately designed self-contained supplementary parts.

The Cyril Bath Co., 6910 Machinery Ave., Cleveland 3, Ohio

An Anti-friction Bearing Lubricant

Texaco High Grease is said to considerably extend the efficient range of operation of ball, roller and plain bearings at high temperatures. The grease exceeds established military and industrial standards in affording unusual protection at temperatures up to 300 F for continuous operation, and 350 F for intermittent operation. It has excellent oxidation resistance and similar desirable characteristics for high-temperature operation.

Texas Co., 135 E. 42nd St., New York, N. Y.



Machine Makes Permanent Hydraulic-Hose Assemblies in 4 Min

A hydraulic hose-coupling machine should enable users of hydraulic hose, including manufacturing plants and industrial jobbers, to save time, avoid delays and reduce costs by making their own hose assemblies.

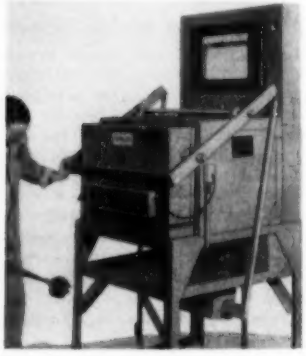
The desk-size machine (floor space 67 x 29 in.) is easy to operate, and does a complete assembly and swaging job. Ample drawer space is provided for needed accessory attachments and material. An operator using this machine can produce a finished hose, coupled at both ends, in 4 min. A 2-piece steel coupling, made by Aro, is used in the process.

A cutting wheel on the machine is used to cut hose to length. For the next step, a wire wheel attachment skives each end of the hose. Then the operator manually assembles sleeve on hose end, inserts coupling with power spinner and places coupling in the press, which swages it permanently in one pass through the die.

The stem of the fitting is so designed that the tube stock of the hose is converted, during swaging, into a series of chevron-type packing rings which give a positive seal. With the tube stock locked in place, cold flow is eliminated. Couplings are made in all popular sizes, with drawing dies for each size provided as standard equipment.

Standard machine is furnished for 110 v. with 60-cycle, single-phase motor.

Pyles Industries, Inc., subsidiary of Aro Equipment Corp., Detroit, Mich.



Cooley Electric Box Furnaces Have Distributed Heating Elements

Formerly available in three standard sizes with working chamber dimensions of 12x18x18 in., 12x8x24 in., and 12x8x36 in., this furnace has a chamber size of 15x12x30 in.

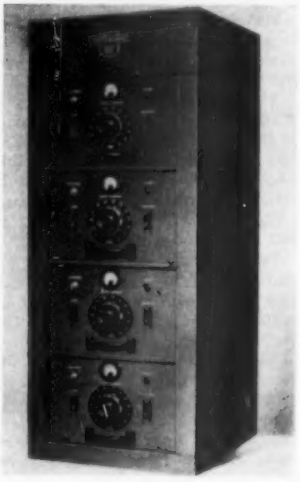
Known as the Model B1, the furnace has the following advantages:

1. It employs Cooley embedded heating units which protect the heavy element wire from atmospheric attack.

2. The elements, formed in ceramic slabs, are located in each side, the bottom, top, rear wall, and the door to give a uniform distribution of heat.

3. Advantage is taken of the slab shape of the elements to cause them to act as baffle walls. Unrestricted air space surround the elements and a natural air convection is thus created, further equalizing the temperatures.

Cooley Electric Mfg. Corp., 915 Daly St., Indianapolis 2, Ind.



Multiple Induction Heater Stations Combined in Single Cabinet

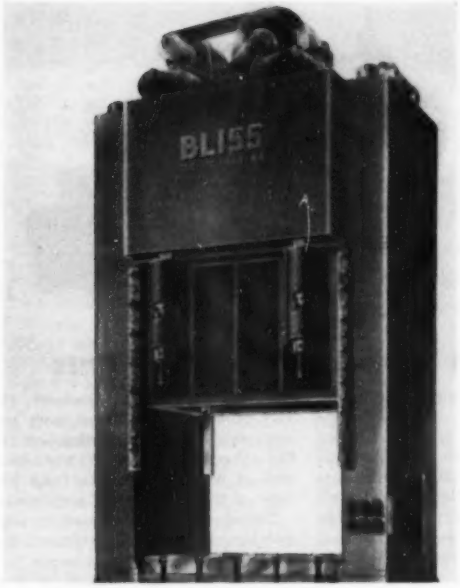
Individual induction heating units can be removed and replaced, similar to a drawer of a filing cabinet. Also, the heating stations can be located at any place in the production line.

The 2½-kw machine, Model 100S, is available in a number of heavy-gage steel cabinets, and any combination designed to meet the user's particular requirements. They may be in the form of heating sections and power supply in one cabinet, or the heating section may be remotely located from the power section. Any number of multiple power supply units are available.

Equipment includes circuit-breaker switches for primary and heat-on circuits, load-indicating ammeter, continuously variable output control for zero to full power, automatic heat-on timer, filament and heat-on indicators, quick disconnect plugs, and receptacles for connecting power section to heating section.

Input requirements per section are 4 kva at 220 v, 60 cycles, single phase.

Induction Heating Corp. 181 Wythe Ave., Brooklyn 11, N. Y.



CIRCULAR-PATTEN DRILLING MACHINE for use in the aircraft jet-engine program, provides great flexibility and drills—without the use of expensive drill and fixtures and with standard indexing—regular or irregular hole spacings of from 4 to 100 indexes and circles up to 48 in. dia. It will take pieces up to 61 in. in diameter. — *New Britain Machine Co., New Britain, Conn.*

Double-Action Toggle Presses For Large-Area Drawn Stampings

A series of 4-point, double-action toggle-drawing presses featuring quick advance and return speeds and extreme accessibility for mainnance purposes, are now available from E. W. Bliss Co. The presses are specially designed to meet the needs of the automotive and allied industries by making posible higher production rates for large-area drawn stampings.

Greater production rates have been made possible through the use of an eddy-current clutch which provides for quick approach to the work, slow-down to give proper drawing speeds and quick return speeds to the top of the stroke. Even with comparatively slow drawing speeds, a rapid press cycle is possible. The slow-down is accomplished by controlled slippage of the eddy-current drive clutch through limit switches which can be adjusted to vary the speed of any portion of the draw cycle.

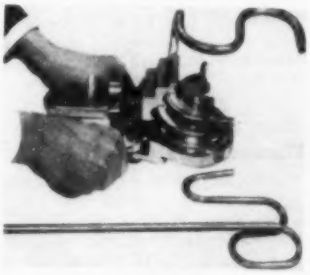
Three substantial cross-members in the crown contain four totally enclosed gears with integral eccentrics for operating the plunger slide. Crown sections beneath the gears form a rigid tie member for the front, center and back transvertical sections. All gearing and toggle bearings inside the crown are lubricated by a cascade oil system.

Each main rockershaft is in one piece and is easily removed from the top of the crown by unshrinking the rockershaft bearing cap tie-rods with Calrod units. The intermediate rockershafts are also removable from the top of the crown.

Provision has been made for pneumatic die cushions in the bed, or the bed can be fitted with a synchronized third motion if required.

The presses are built in a complete line of sizes and widths.

E. W. Bliss Co., Canton, Ohio



Tool Makes Bends Up to 180° in Light-Gage Tubing

Tool makes offsets and bends up to 180 deg. in $\frac{3}{8}$-, $\frac{1}{2}$-, and $\frac{5}{8}$-in. OD, K and L Copper Tubing, brass, bundy weld, steel, and other light-gage tubing.

A hand tool, it requires no vise or fixtures. All three sizes are combined in the same tool. Price—$38.00.

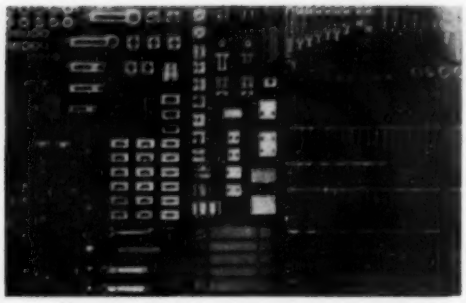
Tal Bender, Inc., Milwaukee 2, Wis.

Pocket-Size Testing Instrument Measures Surface Hardness

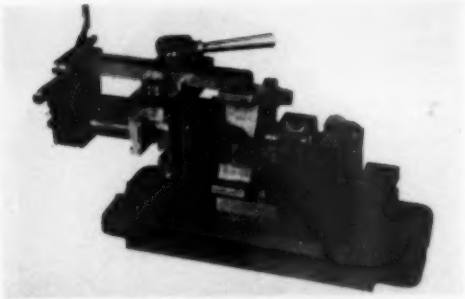
This pocket-size surface-hardness testing instrument for use on non-ferrous material, weighs less than 5 oz and is under 5 in. in length.

Features include direct reading scales, one incorporated accurately correlated numerical equivalents of the Brinell 500 KG. 10 mm ball testing equipment and the Metalometer scale, used as a comparator for all non-ferrous master specimens.

Peabody Industries, 12129 Hamilton Ave. Detroit 3, Mich.



Basic outfit of elements



Example of fixture built-up from basic outfit

Jigs and Fixtures Made From Standardized Elements

The Wharton universal jig and fixture system, British-designed and now available in this country, offers a practical method of unit tooling with unlimited applications. It consists of graduated elements with bases and fastening devices which, when assembled, will make jigs and fixtures for machining or assembling parts for almost any operation.

The main advantages to be gained by the use of the system is said to be in the rigidity and speed of jig and fixture building with an accompanying saving in man-hours and materials, faster production, and no obsolescence of equipment. It is not intended to be used for permanent work, but rather as an additional aid to existing equipment, and is particularly applicable for experimental, development, prototype and small-quantity production.

Basic outfit of the system comprises 450 units, with main components being a rectangular baseplate with various loose elements, clamps, bolts, bushes, V-blocks, etc. They are all mounted on a single shadow board for quick location and easy identification. Basic sets are available in three sizes and there are many other items available as additions to the outfits to meet special requirements. Elements are high quality, wearing parts being made of case-hardened steel and stressed parts of nickel chrome. They are made to a tolerance of 0.0003 in. on all principal dimensions.

The rectangular baseplate, the basis of nearly all the tooling, has T-slots running longitudinally at accurate centers and secondary transverse T-slots at each end. There is also a T-slot in each longitudinal side of the base to which elements can be fixed to provide local extension to the base.

Stop-elements take the thrust of the cut: They are made in various forms and sizes. The one most frequently used has an accurately machined tenon on the lower face for location in the T-slot of the subbase, and a tenon-slot in the upper face for locating and receiving other elements. There are also T-slots in the sides of the stop-elements. On two adjacent sides these slots are vertically and centrally disposed. On the other sides they are horizontal and at definite distances from the base of the element and each other.

Thrust-elements are used to support stop-elements where thrust is too great for a stop-element alone.

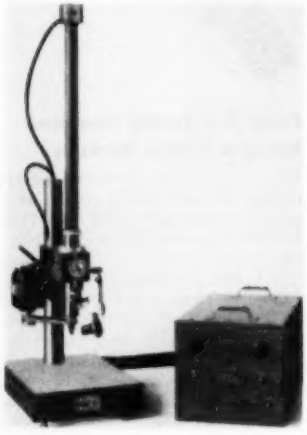
Accurate height location is provided by height elements, made in different thicknesses and shapes to meet varied requirements.

Angle straps are used for bracing together columns of stop-elements. Others are used for joining together two or more sub-bases of the baseplate type.

Other elements include a range of clamps, jacks, V-blocks, and drill-bushing holders.

Although the system was devised for machining fixtures, it also said to have great potentialities for receiver-type gages, particularly for measuring dimensional relationships in different planes.

Wharton & Wilcocks of America, Inc., 17 Battery Pl., New York 4, N. Y.

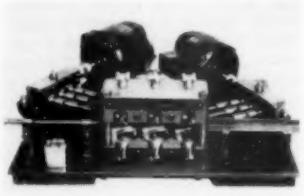


Micro Drilling Machine Has Electronic Feed Control

The Model 200 Microdrill is a precision drilling machine for microscopic holes. Features are: (1) electronic feed control; (2) variable-speed drive; (3) automatic surface stop; (4) automatic depth control, and (5) adaptable to automatic drilling sequence.

Drill capacity ranges from 0.001 to 0.025 in. Drill collet is a standard 0.040 in. or optional 0.032 in. Throat depth is 6 in. Maximum recommended electronic feed travel is 0.20 in. Spindle speed from 0 to 5000 rpm. The platform for work fixtures measures 10x10 in.

Teletronics Laboratory, Inc., 352 Maple Ave., Westbury, L. I., N. Y.



Rotary Straightener for Small Rods and Tubes

Model AYZ rotary straightener, has been designed for the metalworking, electronic, jewelry, instrument, and related industries for removing waves, bends and kinks from cut lengths of 1/16-in. rod or tube up to ¼-in.-OD thin-wall tubing.

Basic feature of the model which is the smallest in a line of 12 machines, is its roll arrangement. It has three sets of identically contoured twin-cross rolls, all power driven. In practice the middle pair of rolls is adjusted up or down so that the correct amount of offset for good straightening effect is maintained between the horizontal middle roll pass and the horizontal entry and delivery roll passes.

Rod or tube is straightened by revolving cut lengths of stock spirally through the three sets of cross rolls. All six ¾-in. dia rolls are angularly adjustable so that each roll bears along its whole face on the rod or tube to be straightened.

This roll grouping combines with the roll design to give two types of straightening action, with straining forces applied over the entire length of rod or tube. Stock as short as 6 in. long can be perfectly straightened.

Six driven rolls are actuated by two 1/6-hp motors. Operating speed on rod or tube is 100 fpm. The unit is said to meet a straightness specification of 0.005 in. in 2 ft of ⅛-in. alloy bar stock.

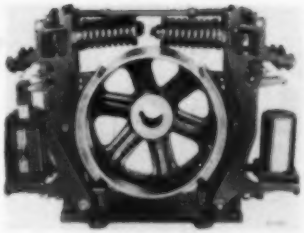
Full accessibility to rolls is secured by three-post construction. It is completely equipped with anti-friction bearings and is 22 in. wide, 19-in. deep and 8-in. high.

Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh 3, Pa.

Browning Cutting Torch Uses Gasoline as Fuel

This torch is claimed to do as much work on 70¢ worth of gasoline as the oxyacetylene torch can perform on a 100-cu ft tank of acetylene. Tests are said to show that the torch, using gasoline and oxygen, makes a faster and cleaner cut under similar conditions than does an acetylene unit. The cutting head is said to eliminate backfiring and backflashing into the torch handle. The torch will be manufactured by the Browning Torch Corp. and distributed by:

Steel News Industries, Inc., R. D. #2, Canonsburg, Pa.



Solenoid-Operated Brake Has Two Independent Shoes

The brake consists of four sets of springs, two solenoids, and one torque tie bolt connecting two independent operating units, one for each brake shoe. Each unit is composed of a set of auxiliary arms and a set of shoe supporting arms, pivoting on the same fulcrum on top of the mounting base. The position on each of the two fulcrums can be changed by setscrews, making it possible to move the whole brake a certain distance to one side or the other in order to bring the center line of the brake to coincide with the center line of the brake wheel. Precision alignment with the motor can thus be obtained after the brake has been mounted on the floor.

The brake shoes are mounted on shoe-supporting arms by a ball and socket pin, making it possible for them to adjust themselves to the wheel. Each brake shoe is provided with two devices to completely eliminate usual toeing difficulties.

The movable fulcrum of the two units make it possible to adjust for wear, both at the bottom and at the top of the mechanism. The anti-toeing devices make the brake shoes an integral part of the shoe-supporting arms, and thus prevent drooping of the shoes against the wheel.

By removing one nut and a gem nut from one end of the tie rod, the two units spread wide open, making it possible to pull the wheel upward with a crane without disassembling the brake.

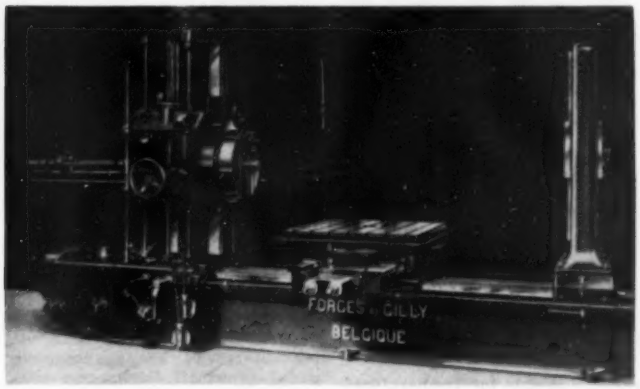
Each unit is provided with a hand release, and one solenoid is capable of releasing the brake by itself. One of the solenoids may then be used as a spare.

The brakes are available for operation as follows: (1) Alternating current operating and holding. The releasing is done by pure ac solenoid and is held in a released condition by the same solenoid without any accessories.

(2) Ac operated, direct current holding. In this case the releasing is done by an ac solenoid. After the solenoid has operated the ac is cut off and the brake is held in a released position by means of a small amount of dc.

(3) Dc operated, dc holding. In this case a dc solenoid is used to release the brake as well as to hold it in.

Trombetta Solenoid Corp., 329 N. Milwaukee St., Milwaukee, Wis.

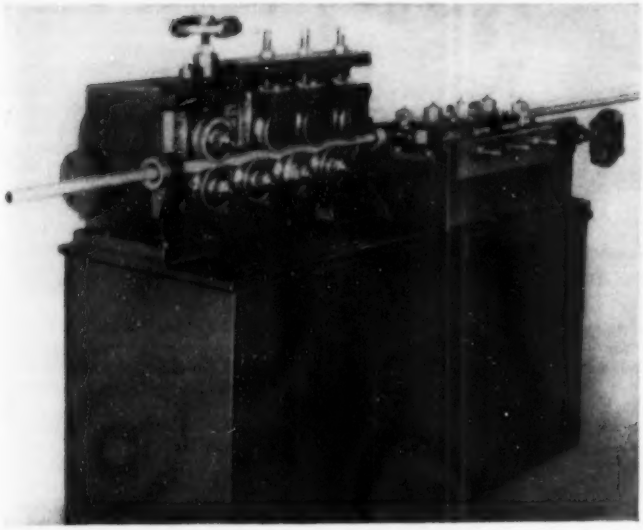


Horizontal Boring, Milling Machines

These Belgian-made machines come in five different models, ranging from 2 1/16-in. spindle diameter to 6 19/64-in. diameter. There are two types of floor boring mills made, having respectively 5⅛-in. and 6 19/64-in. spindle diameter. They are made by the largest maker of this type machine in Europe.

Imported by:

Stokvis, Edera & Co., Inc., 21 East 26th St., New York 10, N. Y.



Tube Does Not Rotate When Passing Through Straightener

Thin-wall tubing of 1-in. O.D. and solid bar stock to ½-in. diameter are straightened on the Shuster two-way-geared roll machine. Power driven feed rolls advance the tube through two sets of rolls, eight rolls to a plance. The tube does not rotate during passage, thus eliminating stock damage such as spiraled burrs, or operator injuries.

The rolls can be supplied for square and hexagon, as well as round stock and tubing. A motor in the base drives rolls set in Timken bearings, while idler rolls have needle bearings. Gear box is enclosed with gears running in oil. Speed range of straightening runs up to 250 fpm. Height adjustments to customer's specifications can be made.

Mettler Machine Tool, Inc., New Haven, Conn.

Freezer Cabinets for Temperatures To 95 F Below Zero

This sub-zero equipment has many applications among which are shrink fits, seasoning gages and precision tools, and for testing metals and materials at subzero temperature.

The cabinet is available in two sizes and equipped with a sub-lid to maintain constant temperature throughout storage compartment and to minimize heat loss.

Temperature control is adjustable for any controlled temperature to as low as 90° below zero in the 1.5-cu-ft model in normal room temperature. Temperatures may be controlled to as low as 80° below zero in the 6.5-cu-ft model in normal room temperature.

Temperature of minus 95 F and 85 F respectively, may be obtained in these models by continuous running. The units are sealed air- and water-tight inside and out for long dependable service. They are equipped with high density, thick, non-setting Fiberglas bats which provide highest insulating efficiency. Refrigerating system in the chests consists of two Tecumseh Hermetic Compressors operating in a two-stage system; the first stage a ¾ hp, and the second, a ¼-hp capacity. 110-120 ac, 60-cycle single-phase current is required.

Revco, Inc., Deerfield, Mich.

Cam Starting Pad Put on Roll-Marking Dies

Roll-marking dies use a standard inclined plane or cam starting pad to secure uniform depth of impression. This also helps the screw-machine operator in tooling setup.

The starting pad on the marking roll die should contact the part during the last 3/16 in. forward feed of any screw-machine cam.

Other improvements on the Model 500-C include: Center of roll die in line with top of shank for easier locating of holder during setup; ratchet-pawl mechanism has been simplified and trips the roll-die to reset it during the last ⅛ to 3/16 in. of the stroke; solid instead of split-yoke construction.

Other features of the roll marker include: only 2 Allen-head setscrews need be removed to replace roll dies; elimination of drag of roll die or type face on marked surface; ability to use interchangeable type or solid roll dies either centered or offset, provision for full 360° starting-point adjustment of die if ever requested.

New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit 7, Mich.

Conrad Low-Temperature Cabinet Eliminates Expansion Valves

Temperatures produced are in ranges of minus 75, minus 100 and minus 130 F. Refrigerants are freon 13 and freon 22, which will not burn or cause explosions in event of a tube leakage. Expansion valves, capillary tubes, and floats in the refrigerant control system have been eliminated. The freon 13 is limited in pressure by the design to approximately 175 lb. Temperature is automatically controlled, and can be recorded.

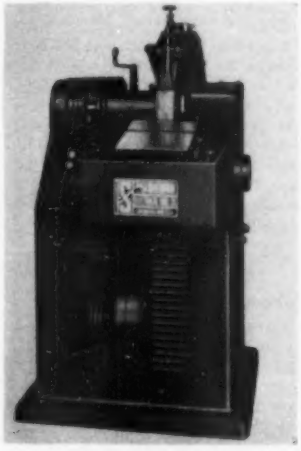
Standard sealed refrigeration machines are used for cooling and special synthetic oils for low temperature. Equipment is all self-contained in the cabinets.

Conrad Industrial Coolers, Holland, Mich.

German-made Micrometer

Each tool is accompanied by an inspection slip stating the exact amount of error at five different points in the range. This is said to be below 0.00005 in. throughout the entire range. Known as the Mastermike, it is designed with a slightly oversized barrel, resulting in wider spacing of graduations and consequent increase of ease and accuracy of reading. It has a dull chrome finish and is available in 0 to 1 and 1 to 2 in. sizes. Imported by:

Karl A. Neise, 381 Fourth Ave., New York 16, N. Y.



Wet Tool Grinder Redesigned

The straight-wheel tool grinder, manufactured by the Standard Electrical Tool Co., has been redesigned and is now available in 14-, 16-, 18-, and 20-in. sizes.

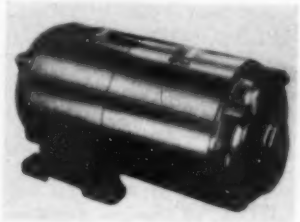
The large area of well-proportioned face with heavy spindle assembly and tilting table serves to deliver precision-ground tools. This straight-wheel wet tool grinder is ideally suited for hogging or snag grinding of carbide tool shanks. The 10x10 in. graduated tilting table has reversible table-top wear plates.

A copious coolant supply is delivered on the wheel and work without spray or splash, through the adjustable nozzle and hand valve. The system includes a self-priming motor-driven coolant pump with relief valve, large-area splash pan, built-in combination settling chamber and coolant reservoir. Individual drains are at each side of the base.

Ball bearings are fully protected in large-size oil reservoir with visual oil gage. Plate-steel wheel flanges with structural plate-steel guard provide maximum safety. A positive shaft lock is for use when changing the grinding wheel.

Cutaway view of base illustrates the 2-step speed on the V-belt drive with safety interlock to prevent overspeeding of the grinding wheel. The speed change permits maintaining maximum cutting efficiency on the reduced diameter of worn grinding wheel. Illustrated is the Model 20S 3-hp grinder with 20-in. dia x 2½-in. face and a 9-in.-hole grinding wheel.

Standard Electrical Tool Co., 2480 W. 6th St., Cincinnati 4, Ohio



High-Frequency Power Supply

400 cycle motor-alternator, meeting AN-E-19 requirements for power supplies, needs little maintenance. It has no rotating coils, requires no brushes or springs, is small in size and is compact. The laminated rotor is mounted in ball-bearings, which are practically wear-free. No other moving parts exist.

Size is 22x12x12 in., and weight 125 lb — making it a portable unit. Outputs are furnished in wattages up to 1000 single-phase, or 1800 3 phase. Single- or 3-phase common-shaft motor drives are available.

Due to the shape of the inductor, the skew of the inductor laminations and other design details, less than 5% total harmonic content exists. Voltage regulation is 1%. Output voltage: 115 single phase, 115/200 3 phase.

American Electric Motors, 4811 Telegraph Rd, Los Angeles 22, Calif.

Viewing Screens Added to SIP Jig Boring and Milling Machine

Viewing screens on which the graduation lines of the built-in standard scales are optically projected with a large magnification, are substituted for the former microscope eyepieces, thereby eliminating operator's eye strain and speeding up settings of SIP jig boring and milling machines Hydroptic 7P and 8P.

The screens are built into the bed and the crossrail and also into the horizontal head on the Hydroptic 8P. They have a rectangular surface illuminated by green light. In the field is a movable reticle in the form of a pair of "beaks," the position of which is controlled by the micrometer drum located close by and reading to 0.0001 in.

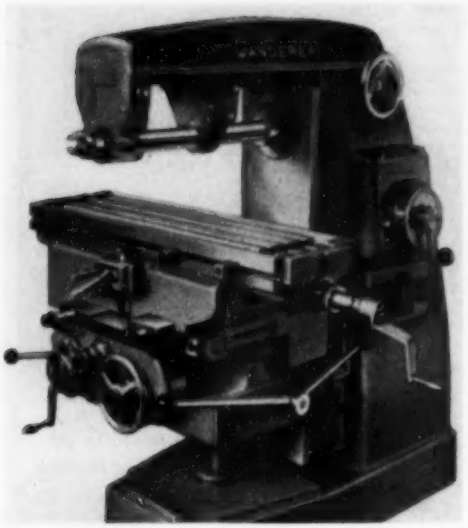
Accurate settings are made with the naked eye by simply centering the projected line between the reticle beaks, using the fine positioning handwheels. They are performed in a few seconds only. Rough settings are performed as formerly on external scales graduated in divisions of 0.1 in.

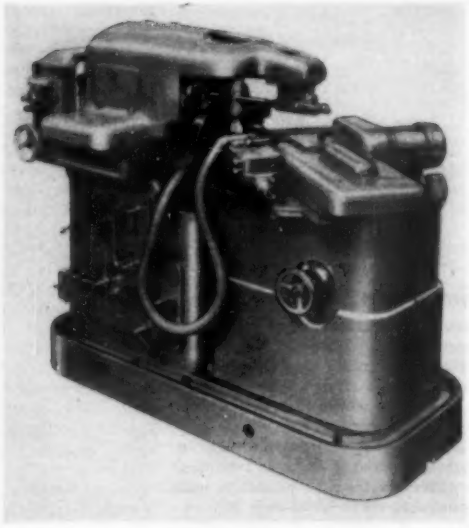
Illustration shows the bed screen on a Hydroptic 7P.

American SIP Corp., 100 E. 42nd St., New York 17, N. Y.

Grease, known as Texaco Multifak 2, is recommended for use where one multi-purpose grease is needed for a variety of operations. It is claimed to have excellent shear stability, resistance against water washing, and good pumpability at low temperatures. It is suitable for bearing lubrication over a wide range of temperatures.

The Texas Co., 135 E. 42nd St., New York, N. Y.





Column Milling Machine Has 16 Spindle Speeds

A versatile, well-built milling machine for single part, series and mass production work is available in plain, universal, or vertical models.

Main features of the Wanderer 1F Column Milling Machine: Clamping surface of work table is 11¾ x 39⅜ in. or 11¾ x 49¼ in. The longitudinal table traverse is 28 or 38 in. Number of spindle speeds is 16, number of feeds 19 in different ranges. It uses a 6.2-hp standard motor and has a built-in climb-milling attachment. The vertical milling machine is also suited for boring and die-sinking jobs. The table of the machine can be supplied with a universal dividing head, including accessories.

Spindle head of the vertical milling machine can be turned 45° in either direction and the spindle is vertically adjustable by 4 in. Machine is available with electric individual drive as optional equipment. Extras, not included in price, fixed vise, swivel vice, milling arbor, and universal dividing head with accessories. Imported by:

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

High Precision Gear Grinder

With this machine, spur and spiral gears are ground with a grinding gear bevelled on both sides. The gear blank is supported on a shaft between centers on the overarm of the machine.

To form the gear tooth, the blank is rolled by the movement of steel belts fixed to the circumference of segments fitted to the end of the arbor. This gives the same effect as a master rack, but is a more versatile solution.

The Kolb gear grinder will grind gears from 1½" p to 12" with a module form 1 to 6. Imported by:

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

DESIGN CHANGES IN LIFT TRUCK permit the use of optional additional counterweights on the standard 2000-lb model, thus increasing or decreasing load center or load capacity as the need requires. This has been done by changing the upright assemblies and load-arm pins.—*Hyster Co., Portland 8, Oregon.*

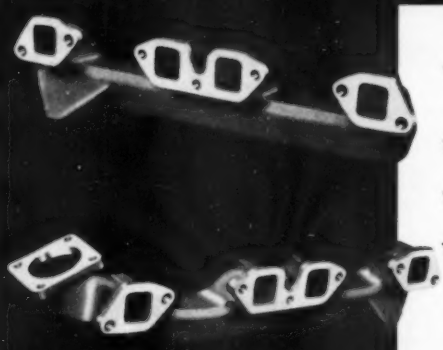
Aluminum Coiled Tubes

For a variety of industrial uses they are available from Aluminum Co. of America. Called Utilitube, they are made of Alcoa aluminum alloy B50S-0, and are said to combine low cost per foot, easy workability and high fatigue strength. If desired, it may be had in lengths up to 100 ft or more, depending on size. Having good flaring and forming characteristics it bends more easily than annealed copper and work hardens less under repeated bending. Utilitube has excellent resistance to vibration and high resistance to corrosion in many exposures including industrial and sea-coast atmospheres. It improves in mechanical properties at sub-zero temperatures, even as low as minus 320 F.

Aluminum Co. of America, 83 Gulf Building, Pittsburgh 19, Pa.

Another Special by Cross

Mills, Drills Bores, Chamfers and Taps Exhaust Manifolds



- ★ Mills and drills mounting face; mills, bores, drills and taps tail pipe pad on 120 exhaust manifolds per hour at 100% efficiency.
- ★ Right or left hand parts machined without changing setup.
- ★ Six stations—one for loading, two for milling, two for drilling and boring, one for tapping.
- ★ Other features: Power indexing; hydraulic feed for milling, drilling and boring; individual lead screw feed for tapping; hardened and ground ways; JIC standard construction; pre-set tools.

Established 1898

THE CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

BUY THE TOOLS YOUR MEN KNOW AND TRUST...

Starrett
SHOP EQUIPMENT
PRECISION TOOLS

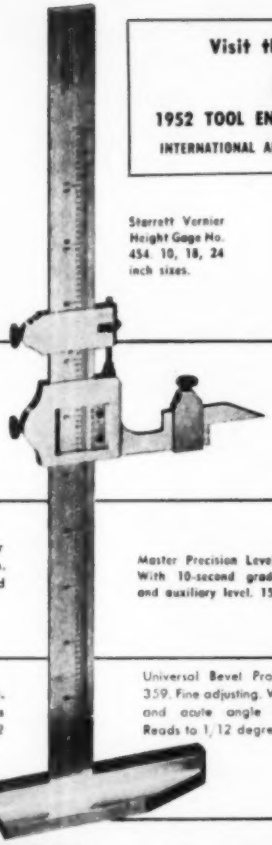
When you buy precision tools for the shop, buy the same kind your men buy for themselves — STARRETT TOOLS. For over 70 years, skilled craftsmen have preferred and used Starrett Tools. They are accustomed to Starrett accuracy, Starrett convenience and Starrett superior design features. They do better work and more of it with tools they know and trust.

Visit the STARRETT EXHIBIT

BOOTH 833

1952 TOOL ENGINEERS INDUSTRIAL EXPOSITION

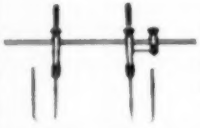
INTERNATIONAL AMPHITHEATRE • CHICAGO • MARCH 17-21



Starrett Vernier Height Gage No. 454. 10, 18, 24 inch sizes.

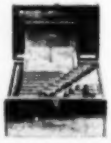
Starrett Vernier Caliper No. 122. 6, 12, 24, 36 and 48 inch sizes.

Starrett Gear Tooth Vernier Caliper No. 456. Two sizes: 20-2 and 10-1 diametral pitch. Also in Metric.



Steel Beam Trammel No. 251. For 18, 26, 36 and 72" dia. circles. With needle, ball, pencil and caliper legs.

Master Precision Level No. 199. With 10-second graduated viel and auxiliary level. 15" long.



Micrometer Caliper Sets No. 436. Sets of six or twelve micrometers covering the range 6-12 or 0-12 inches. In Finished Wood Case.

Universal Bevel Protractor No. 359. Fine adjusting. With Vernier and acute angle attachment. Reads to 1/12 degree.

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Hints for Gage Design . . . I

These data are taken from the proposed Military Gage Design Manual. Much of the information was compiled by the Frankford Arsenal.

METHODS OF GAGE FABRICATION WITH SCREWS

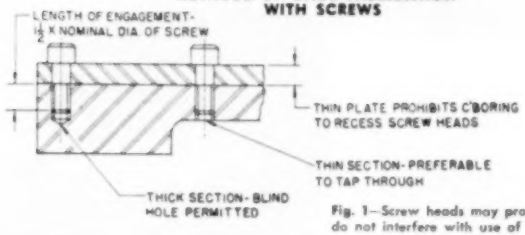
LENGTH OF ENGAGEMENT-
½ X NOMINAL DIA OF SCREW
THIN PLATE PROHIBITS C'BORING TO RECESS SCREW HEADS
THIN SECTION- PREFERABLE TO TAP THROUGH
THICK SECTION- BLIND HOLE PERMITTED

Fig. 1—Screw heads may protrude if they do not interfere with use of the gage

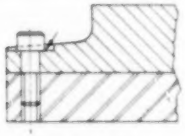

Fig. 2—Spotface rough castings to insure proper seating of screw heads

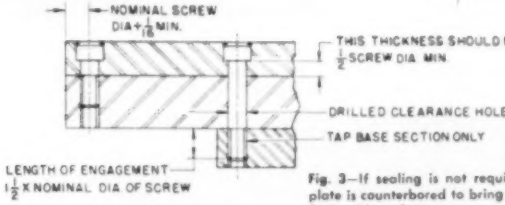
NOMINAL SCREW DIA + 1/16 MIN.
THIS THICKNESS SHOULD BE ½ SCREW DIA MIN.
DRILLED CLEARANCE HOLE
TAP BASE SECTION ONLY
LENGTH OF ENGAGEMENT 1½ X NOMINAL DIA OF SCREW

Fig. 3—If sealing is not required, the top plate is counterbored to bring screw heads flush with surface

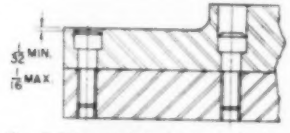

Fig. 4—When sealing is required after gage acceptance, counterbore deeper than the screw head. Deep counterbore (right) eliminates need for unusually long screw

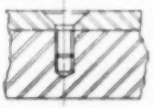

Fig. 5—If top plate is too thin for counterboring, and screw heads must not protrude, countersink for flat-head screw

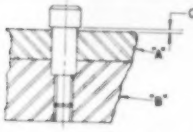

Fig. 6—Use of a shoulder screw permits part A to swivel relative to B. If end thrust on screw is severe, counterbore B at least ⅛ in. deep

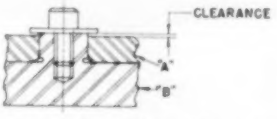

Fig. 7—In this swivel-joint design, a boss is machined on B, and part A is retained by a plain screw and washer

FABRICATION

Fabrication With Screws. This is the most common method of fabricating gages. Generally, gages require standard screws varying in size from 0.164 (No. 8) to ⅜ in. dia. Length of engagement should be approximately equal to 1½ times the screw diameter. Smaller gages, such as built-up snap types and precision locating elements of fixture gages, usually employ a fine-pitch screw. A coarse-pitch screw is considered adequate for securing large fixture gage elements, where precision location is not of vital importance.

Where angularity, alignment or other types of precision location must be maintained within, say 0.0005 in. or less, precision dowel pins or keyways should be used in conjunction with fine-pitch screws.

Fabrication by Welding. Welding is frequently used in the fabrication of large-size fixture gages, and is fast, permanent and economical.

The chief disadvantage with welded construction is the possibility of dimensional change from the gradual release of internal stresses set up during welding. A stress-relieving or artificial seasoning treatment of the welded assembly should always be specified to minimize this effect.

It is not advisable to use welded construction where the weld may set up internal stresses in the area in which precision dimensions must be maintained. Stress-relieving or artificial seasoning may not sufficiently stabilize the physical properties of the metal.

Fabrication by Brazing and Soldering. Brazing and soldering are used mainly for applying carbide inserts, precision balls, and other wear-resistant anvils or locating surfaces to the gage, where there is no extreme shock or impact applied when the component is inserted.

Integral Gage or Part vs Fabricated Type. Manufacturing economy and ease of salvage are prime considerations in determining whether a gage part should be made in one piece or fabricated from several pieces. Parts should be fabricated if complex machining and grinding operations can be eliminated, even though several additional simple operations are required.

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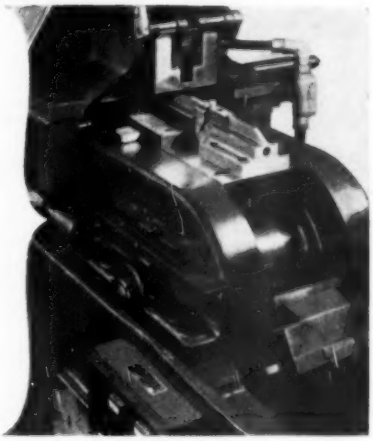

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Hints for Gage Design . . . II

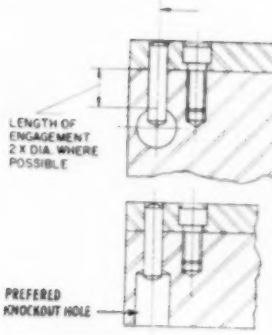

Fig. 8—To maintain angularity, alignment and dimensional accuracy of gage assemblies, precision dowel pins may be used in conjunction with screws. Dimension **A** should be as large as possible to enhance accuracy of location

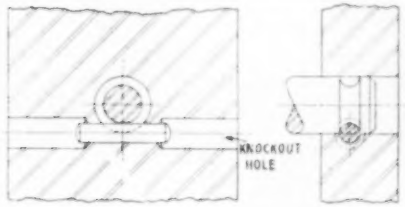

Fig. 9—A short dowel pin is used to retain a rotating shaft. Knockout holes are placed on both sides. If repeated assembling and dismantling of the gage are required, a taper pin is preferred to a dowel

METHODS OF LOCATION WITH TAPER PINS

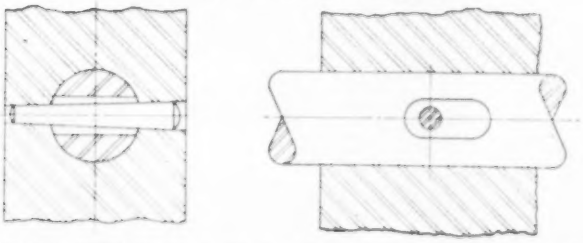

Fig. 10—A tapered pin can be used to retain a sliding pin, and will allow limited movement of the latter. If diameter of the sliding pin and desired movement permit, use a round hole; otherwise an elongated hole

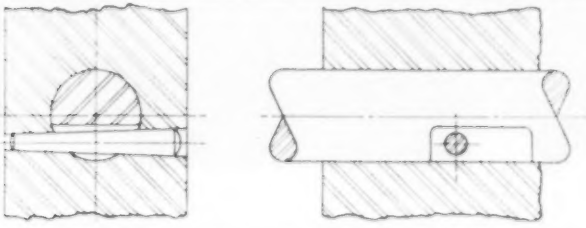

Fig. 11. When sliding pin must be assembled one way, place tapered pin off center

LOCATION

Locating by Dowels. Dowel pins are used mainly to prevent relative movement between precision detail parts of the gage, when a high degree of dimensional accuracy must be maintained. However, in using dowels workmanship plays a large part in the final accuracy. A good fit is imperative. It is advisable to use a dowel pin of 3/16 in. dia. or larger to insure the likelihood of a precision fit, unless space will not permit. Wherever possible, the length of engagement in each piece should be two times the diameter of the dowel. Dowel pins should not be used on gages where repeated dismantling and assembly are required. In this case, the backing up method is preferred.

Locating by Taper Pins. Taper pins are used to serve the same general purpose as straight dowel pins. However, they are less susceptible to poor fits through faulty workmanship. Taper pins are used because of their positiveness of locational repeatability and the relative ease of removal.

Locating by Keyways. Keyways provide an ideal method of maintaining locational accuracy in one direction. However, the main disadvantage of this method as compared to dowels or taper pins is the higher cost entailed in the machining process.

A keyway will prevent shifting in only one direction. Therefore, dowels are usually employed to overcome shift in the other direction. Two keyways placed at right angles to one another may be used in special cases, to maintain absolute locational accuracy.

Keyways are used where locational accuracy must be maintained on several interchangeable elements which are common to one particular gage.

The use of keyways is highly satisfactory where the factor of strength must be considered in maintaining locational accuracy.

Locating by Backing-up Method. By using a finished surface to back up a gaging element, locational accuracy can be maintained by using fine-pitch screws properly located. Two finished surfaces in planes 90° apart will provide locational stability in two directions. This particular method of locating provides for repeated dismantling and assembly without loss of dimensional accuracy.

ADJUSTING DEVICES

Screws. The use of screws is a very

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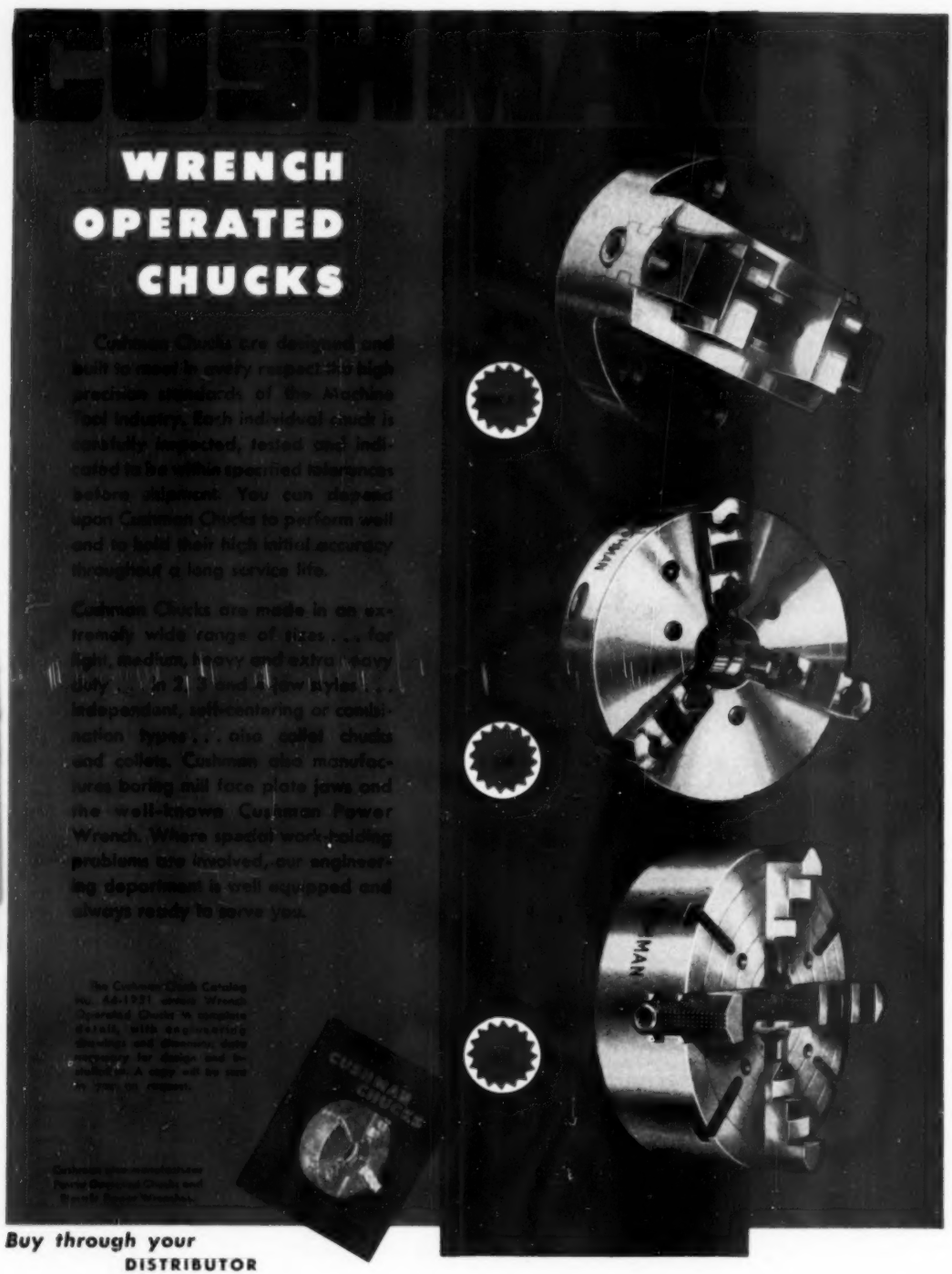
The Cushman Chuck Catalog No. 44-1931 covers Wrench Operated Chucks in complete detail, with engineering drawings and dimension data necessary for design and installation. A copy will be sent on request.



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ICS12

Hints for Gage Design . . . III

common method for providing adjustment on gages. A fine-pitch screw will usually suffice for most adjusting devices. Various special screws are also used for locating and anti-backlash devices.

Locators and Special Mechanism. Where speed is essential in the operation of the gage, special quick-acting adjusting devices should be designed, using locating-buttons and spring-loaded gage elements, in order that adjustment may be accomplished in minimum time.

INTERCHANGEABLE GAGE ELEMENTS

Gage designs that employ several adapters or gage units with the same basic gage should be designed on an interchangeable basis.

Gage designs that employ elements subject to extreme wear and possible breakage should be designed on an interchangeable basis to permit rapid replacement and/or repair of the part.

When a gage part or mechanism is designed that can be widely adapted for use on other gages, a separate drawing should be prepared. The parts should be cataloged or indexed to provide an easy reference for the designer. The use of standard parts will generally reduce costs and delivery time.

Commercial Gages or Parts. The use of commercial gages is preferred wherever their application is practical. In general, procurement time and costs are less as compared to specially designed gages.

Universal Type Gages. A universal-type gage is one that gages a particular function on various sizes of one type of material. The gage in itself is designed on an adjustable basis to include the necessary size range. Care should be exercised to insure that the expense entailed to include a wide size variation will be amortized by the use of the gage. It is often better to provide a series of two, three or four universal type gages to cover a certain size range than to design one more expensive and more cumbersome gage to cover the entire size range.

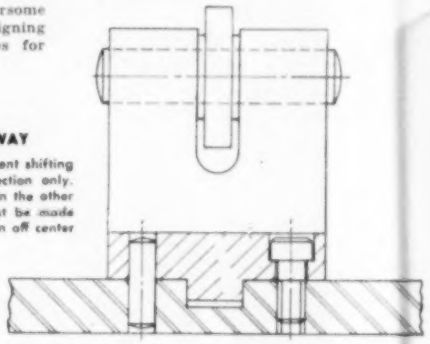
The development of universal type gages is to be encouraged particularly where they can be applied to a series of experimental items which do not warrant individual special gages. The designer should employ as many standard parts, interchangeable elements and commercial parts as possible in designing this type of gage.

Castings vs. Machined Parts. Generally, it is advisable to cast most bases and frames for large fixture gages. Gaging elements which are difficult to machine or fabricate should be cast. Savings can usually be realized by supplanting complex machine parts and large cumbersome pieces with castings, when designing standard gage parts or gages for standardized items.

Quick Operating Devices. Complicated fixture gages usually are slow in operation. Therefore, the use of various quick-operating devices is recommended to reduce the unit component inspection time. This particular phase of design should always be given careful consideration.

LOCATION BY KEYWAY

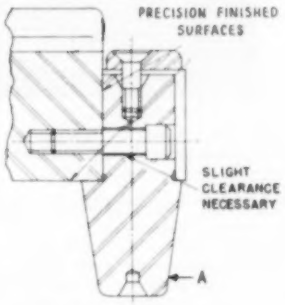
Fig. 12—One keyway will prevent shifting of gage members in one direction only. Dowel pins overcome shifting in the other direction. If the assembly must be made in only one way, locate one pin off center

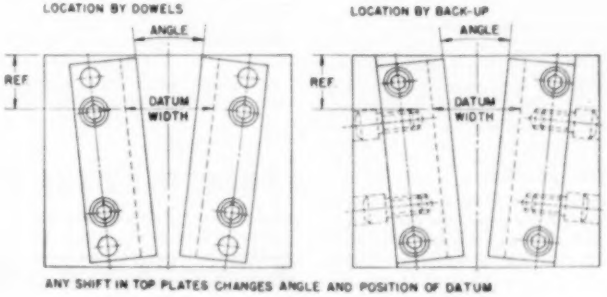


GAGE ELEMENT LOCATION BY BACK-UP METHODS

Fig. 13—Two precision-finished surfaces, in planes 90° apart, provide location stability of part A in both directions. No loss of accuracy occurs from repeated teardown and re-assembly

Fig. 14—In the doweled construction, wear may allow shifting of the top plates, thereby changing the angle and datum. Preferred construction is to grind the angles into flanges in the baseplate. Any shifting of the top plates then does not destroy the angularity and datum dimension





ARMCO 17-7 PH

for lightweight formed structurals

MECHANICAL PROPERTIES of Armco 17-7 PH Compared With Type 301

	ARMCO 17-7 PH SOFT TEMPER		TYPE 301	
	As Supplied (Annealed)	Fabricator Treated (1400 F plus 950 F)	Half Hard	Full Hard
Ultimate Tensile Strength, Psi	130,000 typ. 150,000 max.	215,000 typ. 185,000 min.	150,000 min.	185,000 min.
Yield Strength in Tension, Psi (0.2% offset)	40,000 typ. 55,000 max.	200,000 typ. 165,000 min.	110,000 min.	140,000 min.
Elongation in 2 in., %	30 typ. 20 min.	9 typical 6 minimum	15-18 min.	8-9 min.
Hardness, Rockwell	B92 max. B85 typ.	C45 typ. C41 min.	C-32	C-41
Modulus of Elas. Long.	29,000,000	29,000,000	28,000,000	28,000,000
Density, Lbs. per cu. in. at 70 F.	0.282	0.278	0.29	0.29

Typical Short-Time High-Temperature Properties of Armco 17-7 PH, Soft Temper Fabricator-Treated (1400 F plus 950 F)

Temp. Degrees F	Ultimate Tensile Strength Psi	0.2 Per Cent Yield Strength Psi	Elongation in 2 in. Per Cent	Rockwell Hardness
70	206,500	184,500	9	C 45
300	194,500	174,000	8	—
400	189,000	167,000	6	—
500	180,000	154,000	6	—
600	171,000	141,500	6	—
800	153,000	116,500	8	—

STRENGTH-WEIGHT RATIOS for Armco 17-7 PH Soft Temper
Fabricator-Treated (1400 F plus 950 F)

Strength Property		Ratios Obtained by Dividing Property at Indicated Temperature by Density			
		70 F	300 F	400 F	800 F
Ultimate Tensile Strength, Psi (X 1,000)	Typical	775	700	515	550
	Minimum	665	—	—	—
Yield Strength in Tension, Psi (X 1,000) (0.2% offset)	Typical	720	626	510	419
	Minimum	593	—	—	—
100 Hr Stress—Rupture Strength, Psi (X 1,000)		—	—	583	446
Creep Strength, Psi (X 1,000) (0.1% in 1,000 hr)		—	—	521	180
Modulus of Elasticity, Psi (X 1,000,000)		104	—	—	—

Here is a stainless steel that *has* the best combination of qualities required for lightweight formed structurals.

High Strength-Weight Ratios

At Normal Temperatures:
Strength-weight ratios of Armco 17-7 PH Soft Temper (after hardening) are superior in some instances to the newly introduced non-ferrous light alloys.

At Elevated Temperatures:
Up to 800 degrees F Armco 17-7 PH maintains high strength and *improves* its strength-weight ratios in comparison with the non-ferrous metals, which weaken rapidly above 300 degrees F.

Easily Fabricated

Armco 17-7 PH is supplied in the annealed condition suitable for intricate drawing and forming operations. It is heat treated *after working* by the fabricator. Its high strength is developed through a precipitation-hardening treatment at temperatures of 1400 and 950 degrees F — low enough to avoid serious distortion. On the other hand, High Strength Type 301, the standard stainless structural grade, is supplied in a highly work-hardened condition. Fabrication is difficult and results are often non-uniform.

Other Advantages

Armco 17-7 PH Soft Temper, after hardening, has a yield strength in compression *as good or better than* the yield strength in tension. It has good high-temperature tensile, creep and stress-rupture properties, as well as excellent corrosion resistance.

How Supplied

Armco 17-7 PH Soft Temper is supplied in sheets, strip, plates, angles, special shapes, bars and wire.

Other PH Grades

There is also a "Hard Temper" Armco 17-7 PH and a bar grade, Armco 17-4 PH. For full information write for data on Armco Precipitation-Hardening Stainless Steels.

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News of Metalworking

MANPOWER EBB AND FLOW — A million men will have to be discharged from military service during next 16 months, and at least the same number will have to be taken from civilian life to replace them. And with no more than two million men available in the net manpower pool over the next year, deferments—not easily come by up till now—are going to get even tougher, according to Washington manpower heads. Right now less than 30,000 are deferred for occupational specialties.

FIRST ENGINE DELIVERED — The first aircraft engine built by the automotive industry since World War II was delivered to the Air Force February 13 by Kaiser-Frazer Corp. The Wright Cyclone R-1300 piston-type engine was built at K-F's Detroit Engine Div. plant which also is producing engines for civilian automobiles. The engine was assembled from parts supplied by Wright Aeronautical Co.

STUDY TOOL-BIT MATERIALS — American Electro Metal Corp. of Yonkers, N. Y., has awarded a contract to the Research Div., New York University College of Engineering, to cover studies of proper cutting angles, feeds and speeds for new toolbit materials.

GE CUTS COST OF MAKING JET BLADES

LOCKLAND, OHIO—Turbojet compressor stator blades can be made by rolling the blade material in long strips of airfoil cross-section, cutting to length, inserting in a separate base, and welding.

Cost savings of 55% and large time savings will be possible through fabrication instead of forging as at present, according to C. W. LaPierre, manager, Aircraft Gas Turbine Div., General Electric Co.

The base is shaped to have not only an opening of airfoil section, but also to replace the present blade ring, thus to cut assembly costs.

GE laboratory engineers say they employed a principle used for some time in steam-turbine manufacture to produce the blade.

The new manufacturing process is expected to crack a bottleneck in the nation's aircraft turbojet engine-production program.

Industry's Plans for Plant Expansion in '52 Will Be Pared

WASHINGTON — American industry's hopes and plans for plant expansion this year will be pared down by Washington.

The scaling back will show up in the form of new government restrictions on construction. The new regulations are just in the planning phases now—they are to be ready on July 1. They boil down to a system of priorities. A project without a high priority—and a lot of industrial plant won't qualify—will have to be delayed to 1953, perhaps 1954.

• **There simply won't be enough** metal left over from more urgent defensive needs this year to build all the new plant that industry wants, the government argues. Specifically, officials feel there won't be enough structural steel for new building, not enough copper and other materials to make the machinery to equip them.

Officials like Defense Production Administrator Manly Fleischmann describe industry's plans to spend $21.175 billion on new plant and equipment this year as overly optimistic in light of anticipated materials supplies.

A group of DPA staffers is making a survey of its own of the whole construction picture for the rest of the year.

The $20-billion expansion that industry wants this year, compared with $18.779 billion in 1951, gives a measure of only a fraction of the pent-up demand for new construction. The controllers have been holding down on non-essential types of construction, for more than a year, on all other categories since last October. Plans for new schools, hospital, roads, stores, office buildings have been piling up at a faster rate even than delayed industrial plant.

On the other hand structural steel production, now at its highest rate since War II, will rise no more than five percent, if that much, over the rest of this year. Even so small a rise in output is dependent on speeding operations of the structural mills—very little new production is being built.

• **The pinch on materials** for industrial equipment, particularly copper, is likely to be an even more serious deterrent to plant expansion.

Mr. Fleischmann and his aides already have a set of priorities for construction. They've been using them in passing on applications for construction permits and actual allotments of steel, copper and aluminum for approved projects.

You can't guess safely at this point what the new priorities will cover. DPA has just begun thinking about them. But you can bet that industrial production strictly for military purposes will be at the top of the list.

Aid Sought for Near-Defunct Contractors

WASHINGTON—The Senate Small Business Committee thinks the Pentagon is interpreting too rigidly Public Law 921. That's the law passed last year enabling the military to grant relief to military contractors who got squeezed pricewise on contracts for the military.

Last week five virtually defunct small manufacturers told the committee they had failed to get relief under the law after they lost money on Army and Navy contracts negotiated prior to or shortly after outbreak of the Korean war.

Sen. Blair Moody, committee head, isn't interested in bailing out every contractor who negotiated a bad contract with the military. "But we do want to help the contractor who has lost money as a result of circumstances over which he had no control," he said.

Senator Moody said the law was passed to grant that kind of relief. However, testimony before committee showed that military has been using as yardstick the "essentiality of the contractor to military supply." That meant that the Pentagon would grant no relief unless its source of supply was threatened—or as long as there were other manufacturers who could produce the same item.

The subcommittee got the military to agree to reopen the cases with the idea of recommending relief—using the hardship yardstick.

New Wholesale Price Indexes for Machinery

NEW YORK — AMERICAN MACHINIST presents here brand new indexes of wholesale prices of machinery and motive products, compiled and calculated by the U.S. Bureau of Labor Statistics. Price indexes are presented in the tables below for the major group (Machinery and Motive Products), seven sub-groups of machinery, and 12 product classes under those seven sub-groups.

For most of these group and product-class indexes it is the first time that official price index numbers have been available. Up to this time no really good price series has been available for the machinery industries.

These new indexes will provide better measures of price changes in individual machinery industries. Now tieing the cost of a contract with movements of the machinery price index will be more meaningful than when a company tied its cost of modernization with increases in the cost of basic metals only.

When used as price deflators, these new price indexes will help to give more accurate measures of physical production in certain industries where dollar figures on shipments were the only source of statistical information before. Now, these dollar figures may be accurately adjusted for price changes.

BLS has been working on this revision of its price index for many years. Changes have been made in the classification system, base period, weights and the calculation method.

MONTH	INDEXES (1947-49=100)				
	1947	1948	1949	1950	1951
ALL MACHINERY AND MOTIVE EQUIPMENT					
AVE	92.5	100.9	106.6	108.6	
JAN	89.7	96.7	106.9	106.0	117.3
FEB	90.0	96.7	107.4	105.7	117.7
MAR	90.1	96.9	107.4	105.7	118.6
APR	90.3	97.1	107.0	105.9	118.6
MAY	91.4	97.2	106.6	106.0	118.6
JUN	91.8	98.9	106.2	106.3	118.6
JUL	92.1	100.9	106.3	107.0	118.8
AUG	93.5	103.6	106.3	109.3	118.9
SEP	94.5	105.0	106.2	110.7	119.4
OCT	95.1	105.6	106.1	111.9	120.2
NOV	95.6	106.1	106.0	112.8	120.5
DEC	96.1	106.7	106.0	116.0	
METALWORKING MACHINERY AND EQUIPMENT					
AVE	93.6	100.8	105.6	111.0	
JAN	90.5	98.2	105.5	106.5	125.3
FEB	90.9	98.4	105.6	106.5	125.3
MAR	91.1	98.5	105.6	106.8	125.3
APR	91.6	98.6	105.7	108.2	125.3
MAY	92.7	98.7	105.7	108.4	125.2
JUN	93.1	99.8	105.7	108.8	124.7
JUL	93.8	99.8	105.8	110.1	124.7
AUG	94.9	101.6	105.7	111.5	125.0
SEP	95.2	103.5	105.6	113.2	125.7
OCT	96.1	103.9	105.5	116.7	126.7
NOV	96.8	104.4	105.5	119.1	128.0
DEC	97.2	104.8	105.5	123.4	
METALWORKING PRESSES					
AVE	93.0	101.7	105.4	116.2	
JAN	86.1	100.9	105.9	110.3	132.3
FEB	86.1	100.9	105.9	110.3	132.3
MAR	86.1	100.9	105.9	110.3	132.3
APR	89.2	100.9	105.9	112.0	132.3
MAY	94.8	100.9	105.9	113.0	132.3
JUN	94.8	100.9	105.9	113.6	132.3
JUL	94.8	102.1	105.9	113.6	132.3
AUG	94.8	102.5	105.4	113.8	132.3
SEP	94.8	102.5	104.5	117.1	132.3
OCT	96.2	102.5	104.5	120.0	132.3
NOV	98.4	102.5	104.5	129.3	132.3
DEC	99.5	102.5	104.5	131.3	

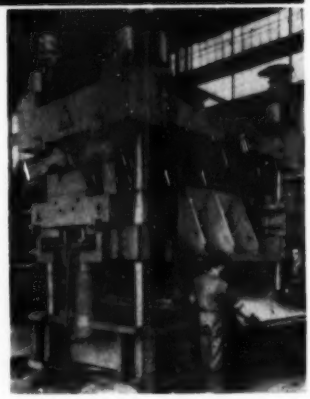
MONTH	INDEXES (1947-49=100)				
	1947	1948	1949	1950	1951
POWER-DRIVEN HAND TOOLS					
AVE	95.9	100.8	103.5	105.8	
JAN	95.3	99.1	103.5	103.0	113.5
FEB	95.3	99.3	103.5	103.0	113.7
MAR	95.3	99.3	103.5	103.0	113.7
APR	95.3	99.3	103.5	103.0	113.7
MAY	95.3	99.3	103.5	103.0	113.7
JUN	95.3	99.3	103.5	103.0	113.7
JUL	95.3	100.6	103.5	103.0	113.7
AUG	95.3	102.2	103.5	105.1	113.7
SEP	95.3	102.2	103.5	109.7	113.7
OCT	97.2	102.4	103.3	109.8	113.7
NOV	97.8	103.0	103.3	109.8	113.7
DEC	97.8	103.0	103.3	112.2	
OTHER METALWORKING MACHINERY					
AVE	92.0	100.1	107.9	112.0	
JAN	88.5	97.1	106.8	108.2	124.1
FEB	88.5	97.3	107.1	108.1	124.0
MAR	88.5	97.6	107.3	108.2	124.0
APR	88.5	97.6	108.1	108.2	124.0
MAY	88.8	98.4	108.1	108.2	124.0
JUN	88.8	98.7	108.1	108.5	124.0
JUL	91.7	100.5	108.2	109.7	124.0
AUG	95.4	101.6	108.2	115.8	124.9
SEP	95.4	102.2	108.2	116.1	124.9
OCT	96.8	102.2	108.2	116.3	124.9
NOV	96.8	102.2	108.2	117.1	129.6
DEC	97.0	105.5	108.2	121.5	
SMALL CUTTING TOOLS					
AVE	95.3	99.3	105.4	111.0	
JAN	94.2	96.2	105.2	106.2	124.1
FEB	94.6	96.2	105.3	106.2	124.1
MAR	94.7	96.2	105.3	106.2	124.1
APR	94.7	96.2	105.3	109.4	124.0
MAY	94.8	96.2	105.3	109.4	123.6
JUN	94.9	96.2	105.3	109.4	123.0
JUL	95.6	96.4	105.6	110.0	121.9
AUG	95.9	98.4	105.6	113.6	121.9
SEP	95.9	103.4	105.6	113.9	123.2
OCT	96.2	104.6	105.3	113.9	123.5
NOV	96.2	105.7	105.3	114.1	123.7
DEC	96.2	105.9	105.3	120.3	
PRECISION MEASURING TOOLS					
AVE	93.6	102.8	103.6	108.3	
JAN	90.6	101.8	103.4	104.0	116.3
FEB	90.6	102.4	103.6	104.0	116.3
MAR	90.6	102.4	103.6	104.0	116.3
APR	90.6	102.4	103.6	104.1	116.3
MAY	90.6	102.4	103.6	104.1	116.3
JUN	90.6	102.4	103.6	104.1	116.3
JUL	90.6	102.4	103.6	106.9	116.3
AUG	94.4	103.2	103.6	109.7	116.3
SEP	98.3	103.2	103.6	111.1	117.6
OCT	98.3	103.2	103.6	114.7	117.6
NOV	99.1	103.2	103.6	115.4	117.6
DEC	100.0	103.2	103.6	116.2	
OTHER ACCESSORIES					
AVE	98.2	100.9	100.9	105.3	
JAN	95.7	100.9	100.9	100.9	113.9
FEB	95.7	100.9	100.9	100.9	113.9
MAR	95.7	100.9	100.9	101.4	113.9
APR	95.7	100.9	100.9	102.8	113.9
MAY	97.2	100.9	100.9	102.8	113.9
JUN	97.2	100.9	100.9	102.8	113.9
JUL	97.2	100.9	100.9	103.7	113.9
AUG	100.1	100.9	100.9	105.9	113.9
SEP	100.9	100.9	100.9	107.7	113.9
OCT	100.9	100.9	100.9	110.1	113.9
NOV	100.9	100.9	100.9	111.3	113.9
DEC	100.9	100.9	100.9	113.9	

are presented

The current index level is about 125 (1947-49 = 100), compared with 190 (1926 = 100) of the old BLS wholesale price indexes. This doesn't mean that prices have fallen one third, but that the revised index is on a different base than the former index.

MONTH	INDEXES (1947-49=100)				
	1947	1948	1949	1950	1951
GENERAL PURPOSE MACHINERY					
AVE	92.6	100.9	106.5	110.3	
JAN	89.9	96.5	107.0	105.9	123.3
FEB	90.3	96.8	107.2	106.0	123.4
MAR	90.5	97.0	107.0	106.0	123.4
APR	90.6	97.6	106.9	106.6	123.4
MAY	91.2	97.9	106.7	106.6	123.4
JUN	92.0	98.0	106.5	107.0	123.4
JUL	92.6	99.7	106.3	108.3	123.4
AUG	93.0	102.5	106.2	111.4	123.3
SEP	94.5	104.7	106.2	113.3	123.5
OCT	95.4	106.1	106.1	114.7	123.7
NOV	95.7	106.6	106.1	116.6	123.8
DEC	95.9	106.9	106.0	121.7	
PUMPS, COMPRESSORS, ETC.					
AVE	92.1	100.4	107.5	109.3	
JAN	90.0	96.6	108.1	105.8	123.4
FEB	90.0	96.7	108.1	105.6	123.4
MAR	90.0	96.7	108.1	105.0	123.4
APR	90.0	96.7	107.5	104.7	123.3
MAY	90.6	96.7	107.5	104.6	123.3
JUN	91.2	96.7	107.5	104.5	123.3
JUL	91.2	98.2	107.5	106.1	123.3
AUG	91.5	101.7	107.5	113.0	123.3
SEP	94.8	104.8	107.5	113.0	123.3
OCT	95.1	105.5	107.5	113.6	123.3
NOV	95.2	106.9	107.2	114.9	123.3
DEC	95.7	108.1	105.9	122.1	
INDUSTRIAL FURNACES & OVENS					
AVE	92.4	99.8	107.7	113.1	
JAN	86.9	96.8	107.7	107.7	128.7
FEB	86.9	96.8	107.7	107.7	128.7
MAR	86.9	96.8	107.7	108.5	128.7
APR	87.0	96.8	107.7	108.7	128.7
MAY	87.9	96.8	107.7	108.9	128.7
JUN	95.7	97.1	107.7	109.6	128.7
JUL	95.7	97.6	107.7	109.6	128.7
AUG	95.7	97.6	107.7	111.0	128.7
SEP	96.3	99.2	107.7	119.3	128.7
OCT	96.5	106.2	107.7	119.3	128.7
NOV	96.5	107.7	107.7	119.3	128.7
DEC	96.8	107.7	107.7	128.0	
IND'L MATERIALS HANDLING EQUIPMENT					
AVE	92.3	101.1	106.6	112.3	
JAN	88.9	96.6	107.2	106.7	127.1
FEB	89.7	97.1	107.3	107.3	127.4
MAR	89.8	97.2	107.4	107.3	127.4
APR	90.0	97.5	107.2	107.7	127.4
MAY	91.4	98.2	106.6	108.1	127.4
JUN	91.4	98.8	106.6	108.4	127.4
JUL	92.5	99.8	106.3	109.3	127.4
AUG	93.9	103.9	106.3	114.7	127.1
SEP	94.2	104.9	106.2	116.1	127.1
OCT	94.7	105.0	105.9	117.6	127.1
NOV	95.7	106.0	106.1	120.0	127.1
DEC	95.7	107.3	106.5	124.0	
MECH'L POWER TRANSMISSION EQUIPMENT					
AVE	90.5	101.9	107.5	110.7	
JAN	84.2	96.1	108.5	106.1	125.9
FEB	85.7	97.3	109.1	106.1	125.9
MAR	87.7	97.5	109.3	106.5	125.9
APR	87.8	97.5	109.1	106.4	125.9
MAY	89.6	99.1	108.9	106.6	125.9
JUN	90.1	99.2	107.1	106.6	125.9
JUL	91.7	101.5	106.4	108.8	125.9
AUG	92.2	104.5	106.4	112.8	125.9
SEP	92.2	106.5	106.4	113.6	125.9
OCT	94.4	108.0	106.6	114.5	125.9
NOV	95.0	108.2	106.1	116.3	125.9
DEC	95.2	108.2	106.1	124.2	

MONTH	INDEXES (1947-49=100)				
	1947	1948	1949	1950	1951
ELECTRICAL MACHINERY AND EQUIPMENT					
AVE	96.1	100.7	103.2	106.4	
JAN	91.2	98.0	106.1	101.1	121.6
FEB	91.5	97.8	106.5	100.3	121.8
MAR	91.8	97.8	106.4	100.7	121.7
APR	92.9	97.6	104.6	100.5	121.8
MAY	97.6	97.3	103.2	100.6	121.8
JUN	98.2	97.6	102.1	102.1	121.8
JUL	98.1	99.9	101.7	104.0	122.2
AUG	98.3	103.2	101.6	109.0	122.1
SEP	98.5	104.2	101.6	110.7	122.1
OCT	98.4	104.4	101.6	114.1	121.8
NOV	98.4	105.0	101.6	114.5	122.1
DEC	98.5	105.6	101.6	119.9	
MOTORS & GENERATORS					
AVE	98.9	100.5	100.6	105.4	
JAN	92.0	100.6	102.6	99.1	121.8
FEB	92.2	99.9	102.6	99.7	121.8
MAR	92.6	99.8	102.3	100.5	121.7
APR	92.9	99.4	102.2	100.9	121.8
MAY	101.3	98.5	101.4	100.9	121.8
JUN	102.8	98.1	100.2	101.4	121.8
JUL	102.3	100.6	99.6	102.0	121.8
AUG	102.4	101.1	99.3	109.2	121.9
SEP	102.1	101.5	99.1	109.7	121.8
OCT	102.1	102.0	99.1	111.5	121.8
NOV	102.1	102.0	99.2	112.1	121.8
DEC	102.1	102.0	99.2	119.4	
ARC WELDING EQUIPMENT					
AVE	96.3	100.6	103.0	107.8	
JAN	94.1	97.0	106.0	102.9	120.0
FEB	94.1	97.0	106.0	103.0	119.5
MAR	94.1	97.0	106.0	103.0	119.0
APR	96.6	97.3	105.9	102.8	119.0
MAY	97.0	97.3	105.6	102.5	119.0
JUN	97.0	97.3	105.6	102.5	119.0
JUL	97.0	97.3	100.8	103.0	119.0
AUG	97.0	104.3	100.1	113.0	119.0
SEP	97.0	105.6	100.1	113.4	119.0
OCT	97.0	105.8	100.1	113.4	119.0
NOV	97.0	106.0	100.1	113.4	119.0
DEC	97.0	106.0	100.4	119.1	
AGRICULTURAL MACHINERY AND EQUIPMENT					
AVE	90.3	101.4	108.3	110.7	
JAN	88.7	96.3	108.4	107.8	118.4
FEB	88.9	96.6	108.4	107.9	120.2
MAR	88.9	96.9	108.4	107.9	120.3
APR	88.8	97.6	108.5	108.1	120.3
MAY	89.1	98.1	108.5	108.2	120.3
JUN	89.5	99.3	108.5	108.3	120.3
JUL	89.5	100.8	108.4	108.4	120.1
AUG	89.9	101.9	108.3	109.7	120.1
SEP	90.5	105.7	108.3	113.2	120.1
OCT	91.5	107.1	108.3	114.7	120.2
NOV	93.4	108.3	107.9	115.8	120.2
DEC	95.4	108.3	107.8	118.2	
CONSTRUCTION MACHINERY AND EQUIPMENT					
AVE	90.8	101.8	108.3	111.5	
JAN	86.3	95.8	108.7	108.0	123.1
FEB	86.9	96.4	108.7	108.0	123.6
MAR	87.0	97.3	108.6	108.0	123.6
APR	87.5	97.5	108.5	108.0	123.6
MAY	88.5	97.6	108.3	108.2	123.6
JUN	89.6	99.3	108.3	108.1	123.6
JUL	90.3	101.4	108.3	108.8	123.7
AUG	90.9	104.1	108.1	112.6	123.7
SEP	91.4	106.7	108.1	114.8	123.7
OCT	92.3	108.0	108.1	115.6	123.6
NOV	93.7	108.6	108.0	116.2	123.8
DEC	94.7	108.7	108.1	121.7	
MISCELLANEOUS MACHINERY AND EQUIPMENT					
AVE	93.8	101.1	105.1	107.4	
JAN	91.7	97.6	104.9	104.8	119.8
FEB	92.4	97.8	105.4	105.0	119.1
MAR	92.6	98.4	105.2	105.0	119.2
APR	92.8	98.5	105.0	105.1	119.2
MAY	93.3	98.8	105.0	105.3	119.2
JUN	93.5	99.2	105.0	105.0	119.1
JUL	93.5	101.0	105.1	105.6	119.6
AUG	93.8	103.1	105.1	107.7	119.6
SEP	94.6	103.9	105.0	109.0	119.8
OCT	95.1	104.6	104.9	110.3	119.6
NOV	96.0	104.9	104.9	111.7	119.6
DEC	96.8	105.3	104.7	114.8	



Brazilian refrigerators undergo final assembly and inspection at the Sao Paulo plant of General Motors do Brasil (above). At right, Frigidaire back panels are stamped on a Clearing 900-ton hydraulic press

Big Output of GM Refrigerators in Brazil

SAO PAULO, Brazil (McGraw-Hill World News)—Twenty thousand refrigerators will roll off the production line at General Motors do Brasil's factory here this year, and only 28% of the manufacturing cost will be made up of imported materials.

Three years of preparation and investment of $1.3 million (U.S.) is represented in the 8000-sq meter section of the GM establishment in which 800 persons are employed on the first large-scale production of household refrigerators in Brazil.

• **Only foreign-built part** of the "box" is the sealed compressor unit. Steel, insulating material, finishes and fixtures all come from Brazil, and are supplied by more than 80 local manufacturers.

Heavy American machine tools made up a large part of the investment.

The 7.4-cu ft model now being made is priced at $545 F.o.b. factory and before payment of local sales taxes. Estimates are that Brazil could consume at least 80,000 household refrigerators annually for many years to come. Only recently standard U.S. refrigerators of about 9 cu ft were priced at only a shade less than the equal of $1000.

European Plants To Get U. S. Orders

WASHINGTON—Off-shore procurement—the placing of defense orders for Nato weapons with European manufacturers—has moved a step closer to reality, with the Defense Department optimistically announcing that the three services would start placing contracts with European manufacturers almost immediately.

Congress has already voted about $620 million (about 11% of the foreign aid budget) for this purpose under the Mutual Security Administration appropriation for 1952.

The contracts, primarily for end items like small arms and ammunition, automotive spare parts, aircraft spare parts, and small naval crafts, would be placed directly with European firms or with the governments for distribution. Prices must be justifiable with comparable U.S. prices. Delivery time must fall within range of delivery time for like U.S. goods. U.S. firms with foreign subsidiaries may participate.

• **The Army will supervise** the Overseas Defense Production program (ODP), as it is called. It's designed to fill the gaps in European defense production base plus getting European firms into the arms production business to ease the burden on U.S. firms.

Self-Employed Now Must Pay Social Security Tax

NEW YORK—January 1, 1952, has been hailed by the Federal Security Agency of the Social Security Administration as a significant date to the country's 4.6 million self-employed. It represents the anniversary of their first year of coverage under the amended Social Security Act, and brings the sole owner or partner in an unincorporated business face to face with the requirement to report his net self-employment income earned in 1951, on or before March 15, 1952.

Income from self-employment, subject to certain exceptions, means net earnings derived from a trade or business covered by Social Security. The manufacturer who works for himself must report and pay the tax of 2¼% on all such earnings over $400 and up to $3,600 starting for 1951. These net earnings may be from full or part-time self-employment. If, in addition, he has wage earnings from a job covered by Social Security, he reports only that part of his self-employment net earnings which, added to his wages, total $3,600 for that year. If his wages are as much as $3,600 he will not need to report his self-employment earnings. All reports are filed with the local Collector of Internal Revenue.

All types of self-employment in a trade or business are covered by this new law. Among the few occupations that do not count toward Social Security protection are farm owners or operators, public accountants, professional engineers who work for themselves, and a few others.

Noble B. Clark

George A. Fyrberg

Ben Butterfield

Clinton F. Robinson

Names in the News

Noble B. Clark has been named to the newly created post of sales manager, Machine Tool Div., Warner & Swasey Co., Cleveland. Mr. Clark, who has been manager of foreign sales, will continue his duties in the export field. He joined the company as a special apprentice, and was a field engineer prior to the foreign sales appointment. Now on a special mission in Japan for National Production Authority, Mr. Clark is completing a three months' tour of duty on loan to the government, and will return to Cleveland shortly.

Reed M. Andress, executive vice president, has been elected president and general manager of Barnes Drill Co., Rockford, Ill., succeeding **W. M. Fairbairn,** who was elected chairman to succeed **A. M. Johnson,** retired after 45 years with Barnes. Mr. Fairbairn has been president and general manager since 1947. **Roger Marriott** was elected executive vice president. Other officers are **A. G. Block,** vice president, secretary, treasurer, and **Harold A. Johnson,** vice president and assistant secretary.

C. W. Thompson has been named vice president and treasurer of Gardner Machine Co., Beloit, Wis. He has been with Gardner for 16 years. **R. E. Price** was named assistant general manager. He was formerly assistant to the president of Landis Tool Co., Waynesboro, Pa., and had been with Landis for 23 years.

Maynard W. McMillan has been named representative for the Baker line of industrial trucks in the southwestern Ohio territory of Baker-Raulang Co., Cleveland. His headquarters will be at Cincinnati.

George A. Fyrberg has been named production manager, Abrasive Div., Norton Co., Worcester, Mass., succeeding **Harold C. Dunbar,** retired after 39 years with the firm. Mr. Fyrberg, who joined Norton in 1915, has been order service superintendent since 1944.

Ben Butterfield has been named manager, eastern sales district, Greenfield Tap & Die Corp., Greenfield, Mass., with headquarters in New York. He succeeds **Glen Chapman,** retired. Mr. Butterfield will be succeeded in the Philadelphia-Baltimore-Washington area by **John Barr,** formerly of the New York staff. **Daniel Wehn** was named New York office manager.

Earl J. Cunningham has been named general manager of the General Electric Co's Industrial Heating Dept., Schenectady, N.Y. He became acting manager of the department in April last year when **Carl L. Ipsen** relinquished the managerial post to accept an advisory position with NPA. Mr. Ipsen has returned to the company as consultant in the Industrial Heating Dept. **Jesse A. Gardenier,** production manager of the Large Motor & Generator Dept. has retired after 50 years with the company.

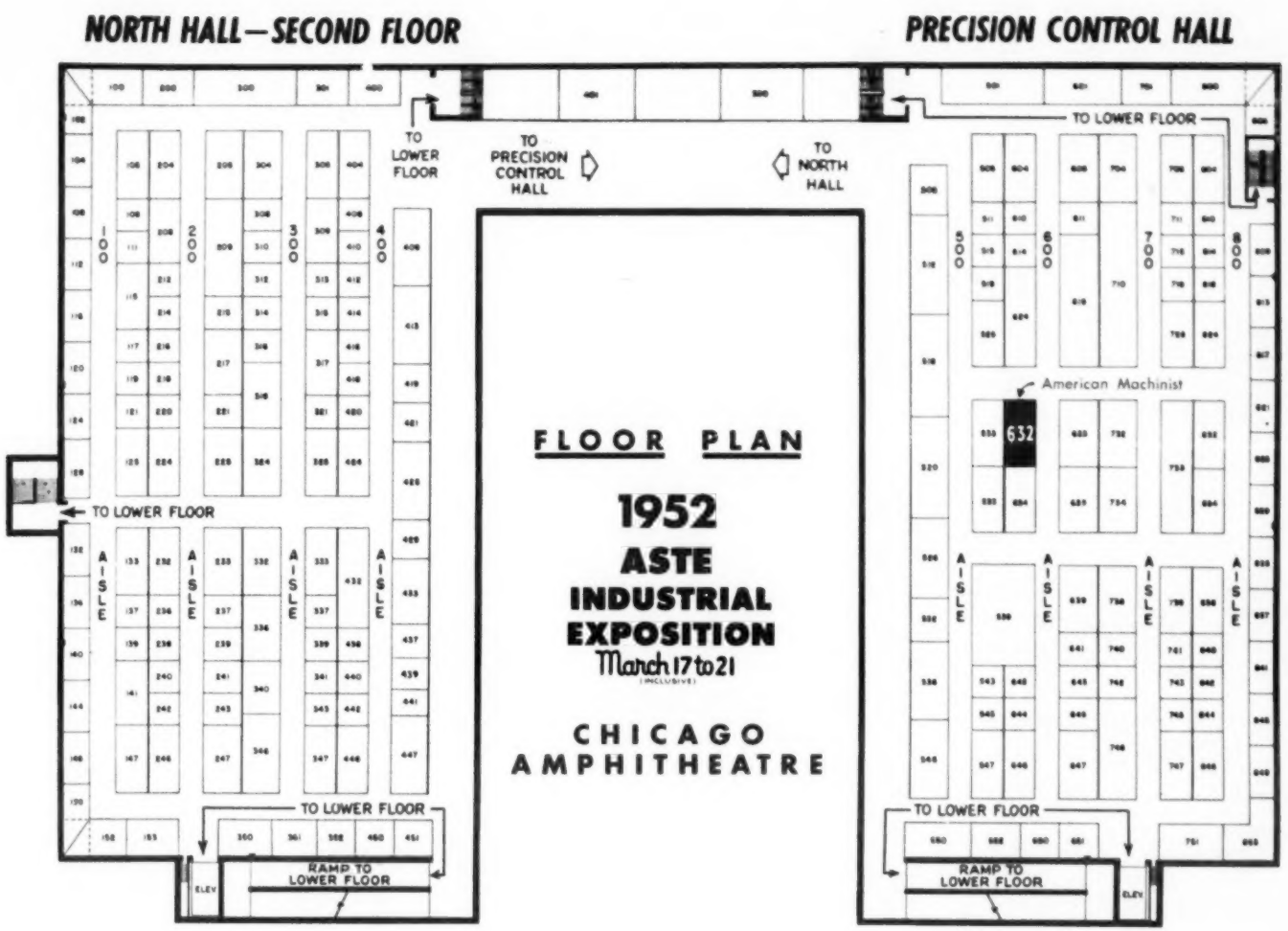
George W. Jernstedt has been named manager of engineering for the Special Products Development Div., Westinghouse Electric Corp., Pittsburgh. Mr. Jernstedt was in charge of electroplating projects. **George E. Goodrich** has been named assistant manager, industrial department, Apparatus Div. He was resale manager, middle Atlantic district.

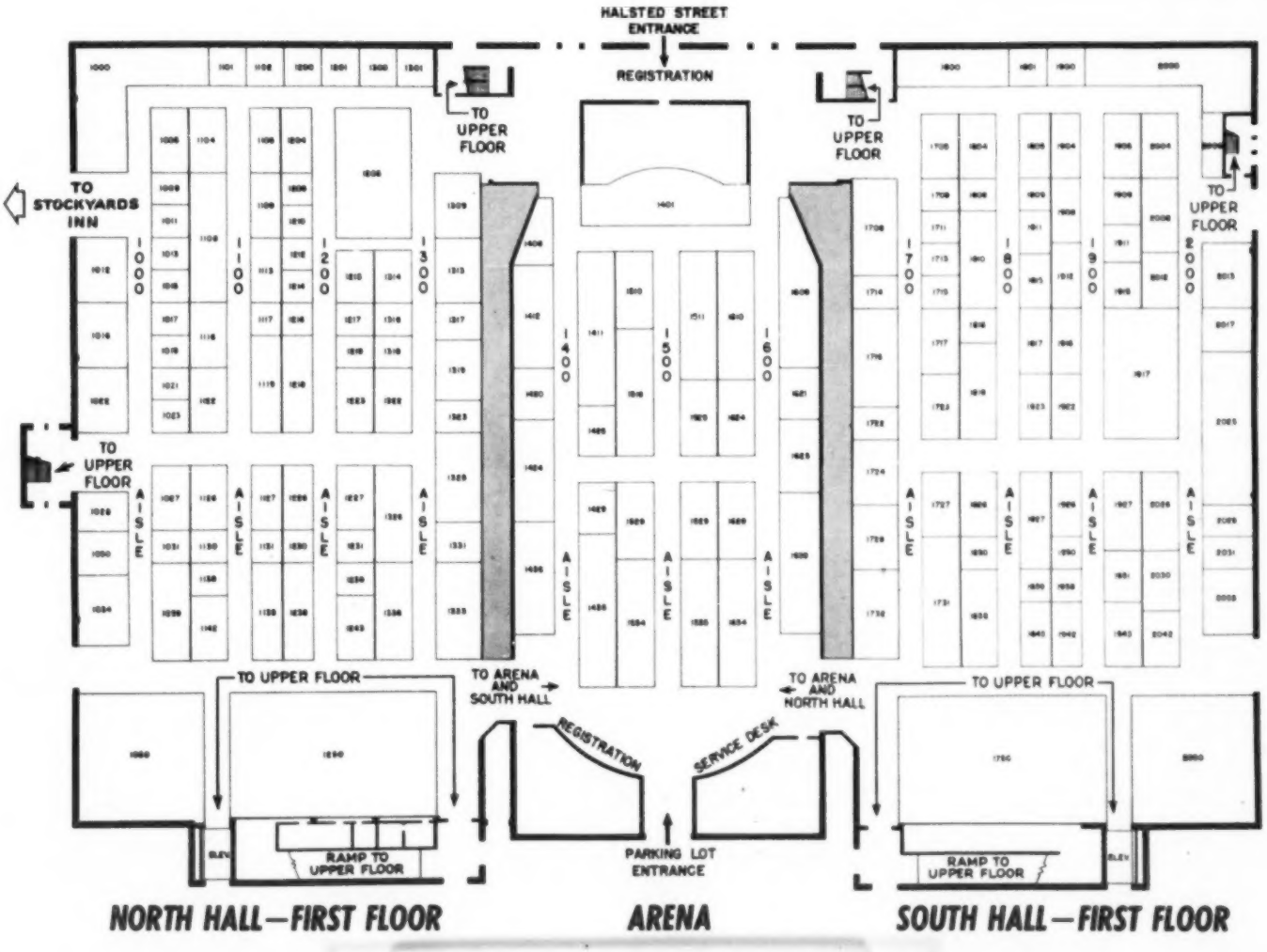
Clinton F. Robinson has been elected president and director of The Carborundum Co., Niagara Falls, N. Y., to succeed **H. K. Clark** who resigned as president. **Paul B. Brown, Clarence E. Hawke,** and **William H. Wendel,** formerly managers of the Bonded Products and Grain Div., Refractories Div., and Coated Products Div. respectively, were elected vice presidents in charge of their divisions. Mr. Clark will continue with the company as a director. Mr. Robinson was formerly president of Frederic B. Harris Co., New York.

John W. Brigham has been named sales manager of Baker Brothers, Inc., Toledo, Ohio. He joined Baker Brothers in 1925,has been assistant sales manager since 1942. **John P. Nugent** was named assistant sales manager. He joined the firm in 1945, and since 1946 has been a sales engineer in the Detroit automotive area.

Dr. John T. Rettaliata, vice president and dean of engineering at Illinois Institute of Technology, has been named president of the Institute, succeeding **Dr. Henry T. Heald** who leaves Chicago to become chancellor of New York University. Dr. Rettaliata also was named president of the Institute's Armour Research Foundation and the Institute of Gas Technology.

Maj. Gen. Donald L. Putt has been named vice commander of the Air Research & Development Command of the Air Force, at Baltimore, Md. Gen. Putt was acting deputy chief of staff at Washington, and before that assistant deputy chief of staff for development. The Air Research & Development Command moved its headquarters to Baltimore from Dayton in June 1951.


NORTH HALL—SECOND FLOOR
PRECISION CONTROL HALL
TO LOWER FLOOR
TO PRECISION CONTROL HALL
TO NORTH HALL
TO LOWER FLOOR
American Machinist
632
FLOOR PLAN
1952
ASTE
INDUSTRIAL
EXPOSITION
March 17 to 21
(INCLUSIVE)
CHICAGO
AMPHITHEATRE
TO LOWER FLOOR
RAMP TO LOWER FLOOR
ELEV
TO LOWER FLOOR
RAMP TO LOWER FLOOR
ELEV


HALSTED STREET ENTRANCE
REGISTRATION
TO UPPER FLOOR
TO STOCKYARDS INN
TO UPPER FLOOR
TO UPPER FLOOR
TO UPPER FLOOR
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
AISLE
TO ARENA AND SOUTH HALL
TO ARENA AND NORTH HALL
TO UPPER FLOOR
TO UPPER FLOOR
REGISTRATION
SERVICE DESK
RAMP TO UPPER FLOOR
PARKING LOT ENTRANCE
RAMP TO UPPER FLOOR
NORTH HALL—FIRST FLOOR
ARENA
SOUTH HALL—FIRST FLOOR

1952 ASTE INDUSTRIAL EXPOSITION

CHICAGO AMPHITHEATRE, CHICAGO, MARCH 17—21

LIST OF EXHIBITORS

A

	BOOTH NO.
American Machinist McGraw-Hill Publishing Co.	632
Accurate Bushing Co.	838
Ace Drill Corp.	144
Acme School of Die Design Engineering	644
Acme Steel Co.	1226
Acme Tool Co.	128
Adamas Carbide Corporation	1301
Allegheny Ludlum Steel Corp.	1218
Allen Mfg. Co.	116
Allied Products Corp.	225
Allis-Chalmers Mfg. Co.	1728
Allison Co.	1204
American Cystoscope Makers, Inc.	825
American Machine & Foundry Wahlstrom Tool Div.	1131
American Pullmax Co.	1943
American Sip Corp.	1917
American Society of Tool Engineers	401
American Wheelabrator & Equip. Corp.	1215
B. C. Ames Co.	
Amlintool, Inc.	1030
Ampco Metal, Inc.	1119
Anchor Coupling Co., Inc.	304
Anderson & Sons, Inc.	834
F. E. Anderson Oil Co.	1309
Angier Corp.	141
R. B. Annis Co.	614
Armstrong Bros. Tool Co.	133
Aro Equipment Corp.	1810
Arrow Tool & Reamer Co.	117
Atlas Press Co.	1510
Atrax Co.	1722
Austenal Labs., Inc.	552

B

	BOOTH NO.
Eric R. Bachmann	1817
Barnes Drill Co.	1808
W. O. Barnes Co.	1300
E. A. Bambach Mfg. Co.	1714
Bausch & Lomb Optical Co.	813
Bay State Abrasive Products Co.	409
Beaver Tool & Engineering Corp.	1219
Beckett-Harcum Co.	1116
The Bellows Co.	1424
Benchmaster Mfg. Co.	1805
Bendix Westinghouse Automotive Air Brake Co.	1717
Bijur Lubricating Corp.	641
Black Drill Co.	446
Edward Blake Co.	1711
Henry P. Boggis & Co.	1709
Boice-Crane Co.	136
Bokum Tool Co., Inc.	121
Boyar-Schultz Corp.	1438
British Industries Corp.	1205
Brown & Sharpe Mfg. Co.	1435
Charles Bruning Co., Inc.	746
The Brush Development Co.	821
Bryant Chucking Grinder Co.	
Buck Tool Co.	153
Burg Tool Mfg. Co.	1113

C

Cadillac Stamp Co.	853
Campbell Machine Div. American Chain & Cable Co.	1126
Capewell Mfg. Co.	
Carbaloy Dept. General Electric Co.	539
The Carborundum Co.	1326
W. R. Carnes Co.	137
Chicago Dial Indicator Co.	511
Chicago Pneumatic Tool Co.	425
Chicago Tool & Engineering Co.	310
Chicago Tramrail Co.	218
Chicago Wheel & Mfg. Co.	314
Circular Tool Co., Inc.	634
Cleco Div. Reed Roller Bit Co.	413
Cleveland Tapping Machine Co.	300
Collins Micro-Flat Co.	
Colonial Broach Co.	1201
Columbia Enterprises, Inc.	341
Columbia Export Co., Inc.	1909
Commander Mfg. Co.	1238
Connecticut Tool & Engineering Co.	308
Connors & Davis Sales Corp.	215
Cosa Corp.	1750
Arthur A. Crafts Co., Inc.	741
Crane Packing Co.	1908
Crucible Steel Co. of America	1401
Crystal Lake Grinders	1138

D

Dake Engine Co.	1019
Danly Machine Specialties, Inc.	1610
Dayton Rogers Mfg. Co.	1316
Dazor Mfg. Corp.	845
De Castro & Assoc.	1904
Delta Power Tool Div. Rockwell Mfg. Co.	209
Detrex Corp.	2035
Detroit Broach Co., Inc.	1621
Detroit Power Screwdriver Co.	140
Detroit Stamping Co.	115
Dewalt, Inc.	2005
Eugene Dietzgen Co.	332
Dilley Mfg. Co.	243
Diversified Metal Products Co.	1239
The DoAll Co.	1634
Doerr Electric Corp. Electro Machine, Inc.	208
Doughty Labs, Inc.	
Dow Mechanical Corp.	711
The Dumore Co.	404
Durable Punch & Die Co.	214
Durant Mfg. Co.	837

E

Eastern Machine Screw Corp.	450
Eastern Tool Co.	102
Eastman Kodak Co.	518
Eclipse Counterbore Co.	526
Elastic Stop Nut Corp. of America	217
Electro-Arc Mfg. Co.	100
The Electro-Mechano Company	419
Abrasive Div. Elgin National Watch Co.	740
Elox Corp.	318
Enco Mfg. Co.	610
Engineering Mfg. Co.	125
Engineers Specialties Div.	633
Engis Equipment Co.	525
Ercona Corp.	515
Erickson Tools Div. Erickson Steel Co.	1127
Errington Mech. Lab., Inc.	212
Ettco Tool Co.	1243
Euclid Tool Engr. Co.	545
Everede Tool Co.	1012
Ex-Cell-O Corp.	1708

F

Federal Machinery Sales Co.	1108
Federal Products Corp.	733
Fenway Machinery Sales, Inc.	216
Field Abrasive Specialty Mfg. Co.	312
Firth Sterling Steel & Carbide	725
Fonda Gage Co., Inc.	715
Foote Bros. Gear & Machine Co.	1109

G

Gairing Tool Co.	738
Gammons Hooglund Co.	1231
The Garlock Packing Co.	103
Garvin Bros., Inc.	429
Gerotor May Corp.	1801
Gidding & Lewis Machine Tool Co.	1705
L. H. Gilmer Co. Div U. S. Rubber Co.	236
Globe Heat-Seal, Inc.	1809
Govro-Nelson Co.	119
Graham Machine Tool Co.	1911
Graymills Corp.	224
Green Instrument Co., Inc.	805
F. T. Griswold Mfg. Co.	832
Grobet File Co. of America, Inc.	742
Guthery Machine Tool Corp.	1827
Gulf Oil Co.	647

H

	BOOTH NO.
H. E. B. Machine Tools, Inc.	1800
Hammond Machinery Builders, Inc.	1628
Hanchett Magna-Lock Corp.	645
Hanby & Harman	1818
Hanna Engineering Works	1625
Hannifin Corp.	1609
Hansford Mfg. Corp.	150
Hanson-Whitney Co.	829
Hardinge Bros., Inc.	1516
R. G. Haskins Co.	333
Haynes Stellite Div. Union Carbide & Carbon Corp.	1122
Heintz Mfg. Co.	205
Heli-Coil Corp.	316
Henry & Wright	1325
Hercules Presses, Ltd.	1031
Heston & Anderson Div. St. Paul Foundry and Mfg. Co.	
Hill Clark Francis	
Alfred Hofmann Needle Works, Inc.	1715
Honan-Crane Corp.	1716
Hydroway Scales, Inc.	108

I

Ideal Industries, Inc.	642
Illinois Tool Works	1223
Index Machine Co.	148
Industrial Filtration Co. Del-Park Div.	1230
Industrial Tectonics, Inc.	315
Ingersoll-Rand Co.	1639
International Harvester Co. Mfg. Research Dept.	615

J

J & S Tool Company, Inc.	1922
Janney Cylinder Co.	324
The Charles L. Jarvis Co.	1534
J. G. Jergens Co.	743
Jergens Tool Specialty Co.	350
C. E. Johansson Gage Co.	701
Eric S. Johnson Co.	111
Johnson Gage Co.	817
S. C. Johnson & Son, Inc.	104
Jones & Lamson Machine Co.	1411

K

Kalamazoo Tank & Silo Co. Machine Tool Div.	1021
Kaufman Mfg. Co.	1926
Kelvin Systems Corp.	2050
Kennametal, Inc.	1723
Klingelhofer Machine Tool Co.	2000
The Korfund Company, Inc.	1011
Kurt Orban Company, Inc.	1900

In the following pages are the list of exhibitors, floor plan, and the New Equipment and Parts at the Tool Show sections. By using these pages the visitor gets a preview of what's new in metalworking and can plan his tour accordingly.

L

	BOOTH NO.
Last Word Sales Co.	438
Latrobe Electrical Steel Co.	1732
K. O. Lee Co.	347
Lees-Bradner Co.	2030
Lindberg Engineering Co.	1333
Lipe-Rollway Corp.	1525
F. J. Littell Machine Co.	2013
Logan Engineering Co.	1130
Logansport Machine Company, Inc.	1529
Lovejoy Tool Co., Inc.	1009
The Lufkin Rule Co.	809

M

M-B Products	1217
M. B. I. Export & Import, Ltd.	2025
Macklin Co.	841
Magnaflux Corp. 501 and	1117
Manhattan Rubber Div. Raybestos-Manhattan, Inc.	441
Martindale Electric Co.	1212
Marvin Machine Products, Inc.	1021
Masterform Tool Co.	109
Jas. H. Matthews & Co.	1318
The McCaskey Register Co.	505
McCrosky Tool Corp.	1227
Mechanical Air Controls	2012
Merz Engineering, Inc.	804
Metal Carbides Corp.	739
Metal Cutting Tools Inc.	200
Metal Lubricants Co.	1811
The Metal Removal Co.	535
W. F. Meyers Co., Inc.	1826
Michigan Tool Co.	1200
Micro-Poise Engineering & Sales Co.	818
Micro Switch Div. Minneapolis-Honeywell Regulator Co.	416
The Milford Rivet & Machine Co.	2004
Miller Motor Co.	1731
A. Milne & Company	120
Modern Industrial Engineering Co.	1102
Modernair Corp.	1843
S. A. Mondiale	1030
Moore Products Co.	824
Morey Machinery Co., Inc.	1250
Morton Machine Works	1015

N

National Broach & Machine Co.	1022
National Machine Tool Co.	232
National Tool Co.	1815
Nelco Tool Co., Inc.	410
New Hermes Engraving Machine Corp.	239
Niagara Machine & Tool Works	1314
Nichols-Morris Corp.	1624
Nicholson File Co.	745
Nilsson Gage Co.	533
Nord International Corp.	124
C. A. Norge Co.	1931
Norton Co.	1839

O

The O. K. Tool Co.	1420
Oakite Products, Inc.	132
Ohio Crankshaft Co.	1425
O'Neil-Irwin Mfg. Co.	1338
Ortman-Miller Machine Co., Inc.	2017
The Osborn Mfg. Co.	1838

P

Pangborn Corp.	1322
Parker Rust Proof Co.	247
Parkwood Laminates, Inc.	238
Perfex Gage & Tool Co.	810
Perrish Steel Products, Inc.	1034
Petroleum Advisers, Inc.	346
Physicists Research Co.	712
Pines Engineering Co.	301
Pioneer Pump & Mfg. Co.	1528
Pioneer Tool & Engineering Co.	547
Pivot Punch & Die Corp.	343
Porter Precision Products	1830
Pratt & Whitney Div. Niles-Bement-Pond Co.	512
Precise Products Co.	1005
Precision Detroit Co.	1713
Precision Diamond Tool Co.	313
Precision Grinding Wheel Co.	340
Procunier Safety Chuck Co.	336
Production Machine Co.	2008
Producto Machine Co.	1104
Progressive Welder Sales Co.	437
Putnam Tool Co.	439
D. H. Prutton Machinery Co.	1816

R

R and L Tools	408
Racine Tool & Machine Co.	432
The Ready Tool Co.	1017
Republic Gage Co.	519
Rice Pump & Machine Co.	1214
J. A. Richards Co.	421
Rivett Lathe & Grinder, Inc.	1027
Ross Operating Valve Co.	2026
H. B. Rouse & Co.	1938
Royal Oak Tool & Machine Co.	1101
Joseph T. Ryerson & Son, Inc.	147

S

S & S Machinery Co.	1050
Sales Service Machine Tool Co.	1942
Salvo Tool & Engineering Co.	352
Schauer Mfg. Corp.	412
George Scharr Co., Inc.	601
A. Schrader's Son Div. Scovill Mfg. Co.	433
Schramm, Inc.	1319
Scully-Jones & Co.	1511
Seibert & Sons, Inc.	440
The Sentry Co.	1930
Service Diamond Tool Co.	719
Service Machine Co.	1804
Severance Tool Industries, Inc.	414
The Sheffield Corp.	710
Sheldon Machine Co.	1408
Shell Oil Co.	112
Simonds Abrasive Co. Simonds Saw & Steel Co.	1314
Size Control Co.	
Socony Vacuum Oil Co.	233
South Bend Lathe Works	1216
Special Engineering Service, Inc.	1142
The Standard Electrical Tool Co.	1727
Standard Gage Co., Inc.	532
Standard Pressed Steel Co.	1535
Staples Tool Co.	639
The L. S. Starrett Co.	833
Steel City Testing Machines, Inc.	611
Steel Products Engr. Co.	1900
Sterling Grinding Wheel Div. Cleveland Quarries Co.	1839
Alemite Div. Stewart-Warner Corp.	201
Edwin B. Stimpson Co., Inc.	1139
Stokerunit Corp.	508
Stokvis, Edera & Co., Inc.	1028
Stone Machinery Co., Inc.	447
Strong, Carlisle & Hammond Co. Mac It Products Div.	844
D. A. Stuart Oil Co., Ltd.	1823
Sub-Zero Products Mfg. Div. Deepfreeze Distr.	
Sunnen Products Co.	1724
Super Tool Co.	1429
Superdraulic Corp.	849
Sutton Tool Co.	420
Swedish Gage Co. of America	701

T

Taft-Peirce Mfg. Co.	624
Taylor Dynamometer Machine Co.	842
The Texas Co.	246
Thomas Flexible Coupling Co.	451
The Tomkins-Johnson Co.	1927
Torit Mfg. Co.	242
Tri-State Machinery Co.	1912
Tubular Rivet & Stud Company	317
Turner Bros.	
Tuthill Pump Co.	2029

U

Union Mfg. Co.	1013
United States Steel Co.	424
Universal Cyclops	520
Univertical Machine Co.	442
Utica Drop Forge & Tool Corp.	221

V

The V & O Press Co. Div. Emhart Mfg.	1331
Vanadium-Alloys Steel Co.	536
Vapor Blast Mfg. Co. 1210 and	1317
Verse-Mil Co.	1916
Verson Allsteel Press	2031
Viking Industries	1208
The Viking Tool Co.	650
Vlier Mfg. Company	321
Vonnegut Moulder Corporation	400

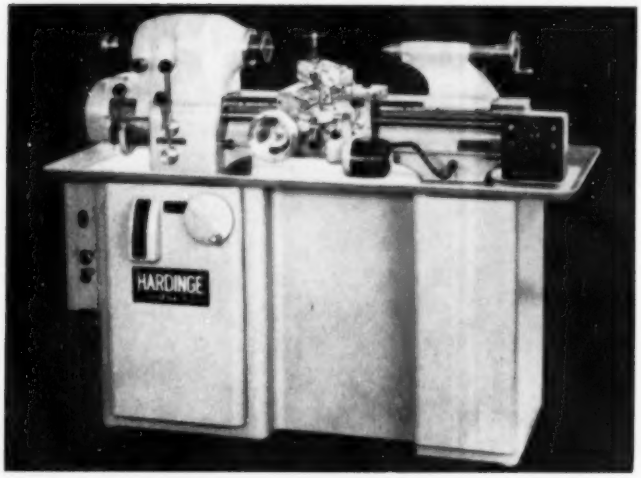
W

	BOOTH NO.
M. Paul Wahlund Mechanical Lab.	543
Weldin Kohinoor, Inc.	751
Wales-Strippit Corp.	1412
Walker-Turner Div. Kearney & Trecker Corporation	1905
Ward Leonard Electric Co. Industrial Chrome Div.	139
Warner Div. Clinton Machine Co.	550
Waukesha Tool Co.	643
The Weatherhead Co.	351
Webber Appliance Co., Inc.	241
The Weldon Tool Co.	305
Wesson Co.	646
West Point Mfg. Co.	240
Wetmore Reamer Co.	747
Westinghouse Air Brake Co. Industrial Products Division	1016
The Whiton Machine Co.	2042
The Wickman Mfg. Co.	1105
Wiedemann Machine Co.	1915
Willey's Carbide Tool Co.	635
Wilson Mechanical Inst. Div. American Chain & Cable Co. Inc.	1126
Wilton Tool Mfg. Co.	237
N. A. Woodworth Co.	1323

Z

Zagar Tool, Inc.	337

NEW PARTS AND EQUIPMENT



Feed Rate Changed Instantly On Hardinge Toolroom Lathe

The Model HLV lathe fills the gap between the plain precision bench lathe and the heavy-duty engine lathe weighing one or two tons. Work is speeded up and accuracy assured through the following three major features:

An independent variable feed for carriage and cross-slide, so the rate can be changed instantly without stopping the machine to shift gears.

An independent variable speed for the headstock spindle to secure every possible combination of speeds within the range of 125 to 3000 rpm.

Precision gearbox and leadscrew reserved for threading only, so the original accuracy is sustained.

The H type lathe carriage has been done away with in favor of a solid rectangular one which rides on hardened and ground steel dovetail bed ways. There are no weakening center slots or openings in the bed. The dovetail design provides one common precision straight edge for aligning headstock, carriage, and tailstock.

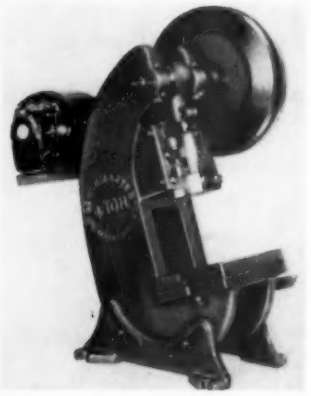
Hardinge Bros., Inc., Elmira, N. Y.

Merz Electronic Ball Gaging and Segregating Machine

This machine gages and sorts precision ball bearings at the rate of 2600 units per hour. It will sort into oversize and undersize, also ten categories of ten millionths, or one-tenth variation, depending on the setting. The Model A, for example, is designed to sort balls ranging in size from 1/32 to 7/32 in. in diameter.

The machine uses standard electronic parts. It has three fused circuits all marked as to their rating. The motor and power fuses are located on the sorting mechanism beneath their respective switches. The Amplifier-Thyratron fuse is marked and located inside the cabinet on the chassis.

Colonial Arts, 515 Fountain Square Theatre Bldg., Indianapolis, Ind.



Benchmaster 4-ton Punch Press Die Capacity Increased In

Where open tooling height, ram up, was formerly 6¾ in., an improved model Benchmaster 4-ton standard punch press possesses a full 8 in., said to be the largest vertical working dimension of any small press.

This additional height is exceptionally valuable for adapting special tooling, for easing setups, and for permitting use of dies and die sets previously too large for the Standard 4-ton model.

Other important improvements are: heavy-duty clutch dog made of special shock-resisting steel; clutch linkage doubled in thickness for greater strength and rigidity; clutch wedge redesigned to incorporate a special safety-stop solid block.

Heavy-duty cast-aluminum flywheel guards for the full line of presses are now available from the manufacturer.

Benchmaster Mfg. Co., 1835 West Rosecrans Avenue, Gardena, California.

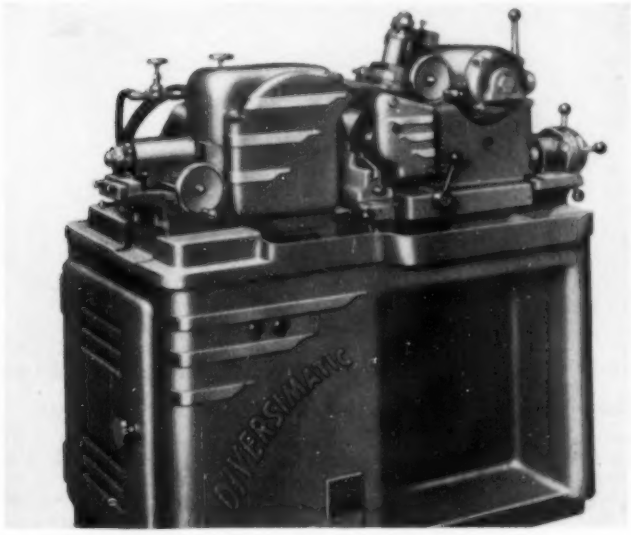
Industrial Chilling Machine Removes 500 Btus Per Hour

The sub-zero W-120 has a capacity of 5 cu ft, and will maintain temperatures as low as 120 deg below zero. It will remove 500 Btus per hour, the equivalent of cooling 20 lb of steel from room temperature to minus 120 F.

The W-120 can be applied to all the jobs that the larger units can do, such as: stabilizing steel, lengthening perishable tool life, and on shrink-fit assembly work.

Sub-Zero Products Mfg. Div. Deep-freeze Distributing Corp., Cincinnati 29

AT THE TOOL SHOW



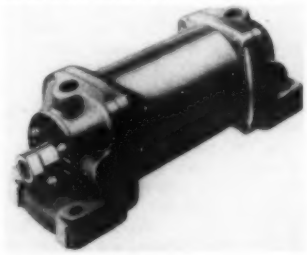
Diversified Centerless Grinder Has Cool-Running Spindle

Grinder features a cool-running spindle which maintains tolerance with no warm-up period before starting the days' operations. It employs a 14x4-in. grinding wheel, and a 7x4-in. regulating wheel. The feed-wheel speed range is infinite from 30 to 350 rpm. Both wheels have built-in diamond-dressing equipment. Known as the Diversimatic, it handles both through-feed and plunge-feed work.

The base measures 35x48 in. Overall height is 54 in. Recommended motors are 2 hp on work to ¾ in. OD, 5 hp from ¾ in. OD to maximum capacity. Capacity ranges from 1¼ in. maximum to decimal diameters.

Diversified Metal Products Co., 5138 Alcoa Ave., Los Angeles 58, Calif.

VAPOR-BLAST LIQUID HONING MACHINE is a small complete unit designed especially for toolroom work. Can be operated from either sitting or standing position. — *Vapor Blast Mfg. Company, Milwaukee, Wis.*



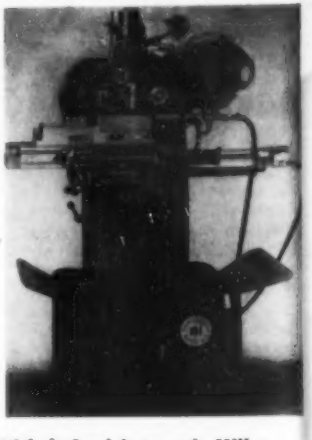
Covers Can Be Rotated On Rivett Air Cylinders

The Rivett air cylinder follows the design of their hydraulic cylinder by using keeper rings to hold covers together instead of tie rods. This permits the covers to be rotated to convenient pipe locations and the cylinder applied in a minimum of space.

Recommended for pressures up to 150 psi, the air cylinders are available in seven mounting styles, in any length of stroke up to 96 in., single or double-end rods, with external or internal thread, and cushioned rod end, blind end, or both.

Other features include: rod bearing provided in area exposed to lubrication; self-adjusting composition cup packing; actual holes through rod bearing provide for pressure disposal on packing members; self-adjusting composition rod packing.

Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.



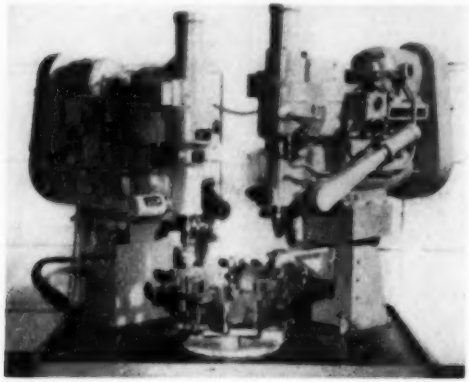
Nichols Semi-Automatic Miller With Automatic Table Feed

The air feed does not interfere with, but supplements the other methods of feeding the table by lever or screw. The unit consists of an air cylinder working in combination with a simplified hydraulic cylinder called Hydro-Chek. This arrangement permits rapid approach of table to the cutter, controlled cutting cycle through engagement of the air-hydraulic unit, and rapid return of table to starting position.

Full power stroke is 9 in., composed of rapid-approach and cutting stroke. Maximum cutting stroke is 6 in., controlled by the Hydro-Chek cylinder. The air cylinder operates on air pressures from 75 to 125 psi.

It is also possible to synchronize automatic opening and closing of air vises with other penumatic work-holding devices, thus reducing operation to loading and unloading, and permitting the operator to serve more than one machine.

Nichols-Morris Corp., 50 Church St., New York 7, N. Y.



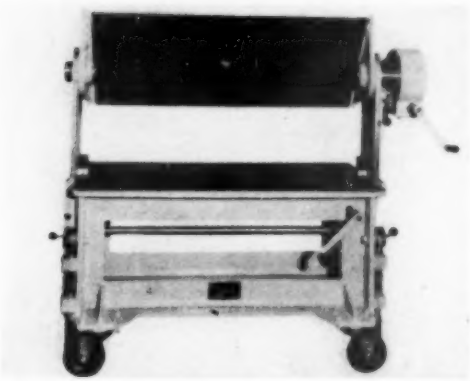
Kaufman Combination Drilling And Tapping Machine

The unit shown is arranged with a No. 10A tapping head, a No. 10 reaming head, and a No. 18 indexing fixture on a special base.

Both heads are arranged for single-spindle drilling, tapping, reaming, and threading. Standard flanges on the quills allow the mounting of multiple heads. Drive is through V-belts to a 6-speed transmission on the reaming head, and through cone clutches in oil on the tapping head.

The indexing mechanism shown is arranged for four divisions, but any number of divisions required can be installed. The fixture shown has sliding workholders indexed to two different positions to drill and tap two holes consecutively. The machine is pneumatically operated and controlled including the index. Ample coolant and chip space is provided in the base. The heads can be powered with either 3- or 5-hp motors, depending upon requirements.

Kaufman Mfg. Co., Manitowoc, Wis.



Hansford Die Handler Has Rotating Platen

This machine can be used for taking a die apart for inspection, or to assemble the die itself.

It will handle dies up to 23 in. wide, 43 in. long, shut height from 9 to 14 in., and weighing up to one ton. The upper platen has a 20x42 in. area and vertical travel of 16½ in. It is mounted on hardened steel trunnions running in anti-friction bearings and can be rotated 360° by the upper handcrank. A locking pin may be used at 5 angular posts.

Four cam-operated legs raise the machine off the floor and level the work for machining or drilling.

Hansford Mfg. Corp., 1239 University Ave., Rochester 7, N. Y.

Universal Dial Test Indicator From Lufkin

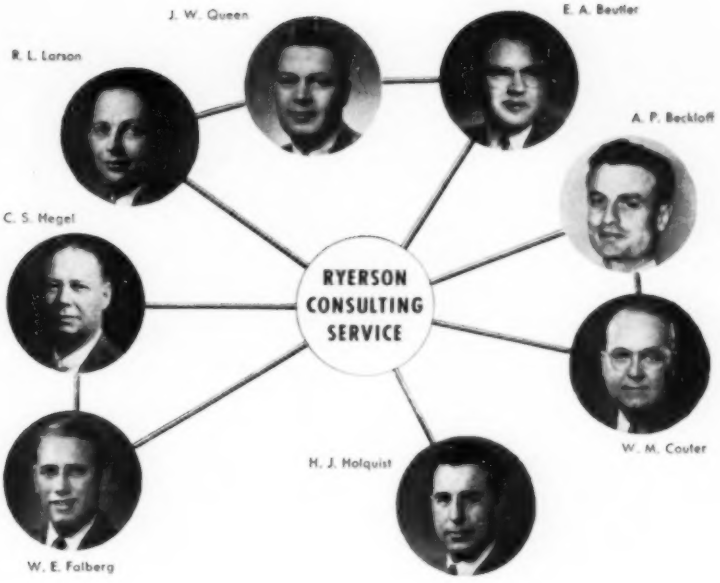
This universal dial test indicator has a 1½-in-dia dial and a contact point attached to a spindle or plunger which extends out of the back of the case perpendicular to the dial. Slightest movement of this contact point is indicated on the dial face by the pointer hand. The unit is lightweight and the entire mechanism is mounted on a bar which forms the base of the indicator and the shank by which it is held. One-piece construction of base and shank assures a rugged tool and prevents loosening of the assembly, even under severe usage. The mechanism being mounted on the one-piece base and shank provides a rigid and accurate alignment of the moving parts independent of the case. Hairspring is on a rigidly mounted main shaft. All greasing and oiling is eliminated.

The jeweled thrust bearing greatly increases the smoothness of operation, insures accuracy and longer life.

It is adaptable for use in connection with a height gage or surface gage. It is useful for determining surface flatness, alignment, out of roundness, relative heights, locations and many other checking functions. The indicator can be clamped in the toolpost of a lathe by using an attachment with an upright spindle and a sleeve.

Lufkin Rule Co., Saginaw, Mich.

AIR GAGE, known as the Comp-air-ator, utilizes the flow-metering principle of measurement; lending itself well to small gaging members and consequently to small-hole gaging. Photo shows a typical 0.058-in. gaging plug with its masters. Flat plugs for measuring slots as small as 0.033 in. are also available. — *The Taft-Peirce Mfg. Co., Woonsocket, R. I.*



Bring Your Steel Problems to These Men . . . at ASTE Booth 147

Here are some of the Ryerson steel specialists you'll meet at the Tool Engineers' Show in Chicago. Each is an expert in his field. Together they make up a consulting service that's ready to work for you.

What is your steel problem? If it concerns the application, selection or processing of carbon, alloy or stainless steel—tubular products or tool steel, these men can help you find the right answer. They can suggest practical alternates for restricted steels. Answer your questions on how to heat treat unfamiliar alloys—weld an unfamiliar stainless. Help you on these problems and many more.

Although a few steels are still in short supply, we can meet most of your requirements promptly from stock. For the complete steel picture, as we see it here at Ryerson, we invite you to write or visit our nearest plant and talk with our men at ASTE Booth 147—March 17 to 23 inclusive.

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JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND
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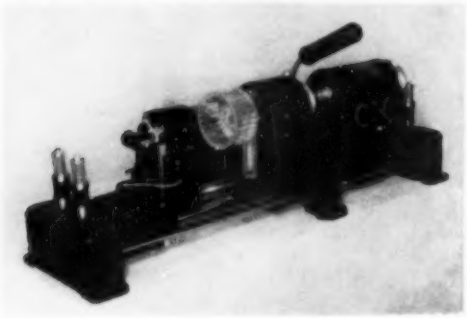


Dynograph Balancing Machine Has Radial Run-Out Attachment

This is a special balancing and run-out checking machine for round rotors and blower wheels ranging in size from 3 to 11 in. in diameter with a maximum face width of 7 in. It has a bed length of 50 in. and is equipped with a standard headstock and photoelectric scanning arrangement for phase indication.

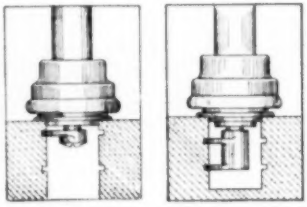
The balancing feature consists of overhung, driven balancing-arbor arrangement, amply sensitive to indicate the unbalance on small rotors, yet sturdy enough to take wheel straightening stresses, etc. without being damaged. For vibration isolation and the elimination of coupling errors, the ½ in. hardened-steel balancing arbor is driven by means of a flat fabric belt from a special motor-drive unit having a fixed front idler for rapid acceleration of work and a braking arrangement for rapid deceleration. The run-out fixture is an extra carriage spaced beyond the outboard end of the balancing arbor, a sufficient distance to allow easy fastening and removal of the rotors or wheels from the arbor. This carriage has a vertical-slide arrangement on which is supported a small photoelectric scanning head which may be adjusted to project a beam of light so as to scan the outboard edge of the blower wheels at the bottom.

Circuits are arranged so that when the selector switch is thrown toward the side marked Balance, the trace on the cathode-ray-tube scale indicates units of unbalance, while with the selector switch thrown to the Run-out side, the trace indicates radial run-out of the rim of the wheel in thousandths of an inch. Position for correction of unbalance and low or high point of run-out are indicated.

By positioning the phasing pip at the bottom of the trace line, the heavy or high side of the work will be stopped in line with a fixed reference pointer, so that correction may be applied. Individual scale calibration is adjustable. Readings are taken in a few seconds time.

A wide variety of work may be balanced on a Dynograph by the use of interchangeable bearings and fixtures.

R. B. Annis Co., 1101 North Delaware Street, Indianapolis 2, Ind.



Grooving Tool Automatically Cuts Internal Recesses

The Waldes Truarc grooving tool is a fully automatic instrument designed for precision cutting of internal grooves. It can be used with drill presses, lathes, or hand machines equipped with chucks or collets.

Simple to adjust for accurate groove-dimension, it can be efficiently operated by unskilled labor. The tool is available in several sizes covering a wide range of groove dimensions. It is also available with special cutters for cutting multiple grooves simultaneously.

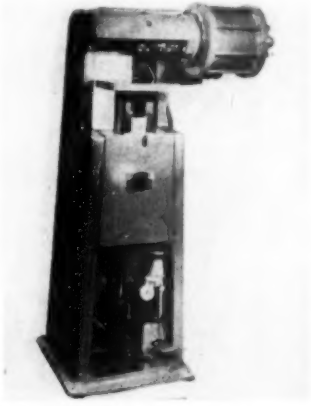
Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N. Y.

German-Made Turret Lathe

The Hestika high-speed turret lathe has a threading attachment, compound cross-slide, 18 spindle speeds from 34 to 2400 rpm, and pressure-lubricated bearings. Importer:

de Castro & Associates, 515-17 Santa Fe Ave., Los Angeles 21, Calif.

ELECTRONIC SORTING GAGE is a completely automatic instrument, hopper feed with automatic disposal unit designed to measure the OD of six different sizes of roller bearings. The workpieces are sorted into six "good" classifications, each equal to 0.001 in., plus oversize and undersize. Gaging speed is 20,000 bearings per hr. — *Federal Products Corp., 1144 Eddy Street, Providence 1, R. I.*



Reciprocating Head Marker Eliminates High Pressures

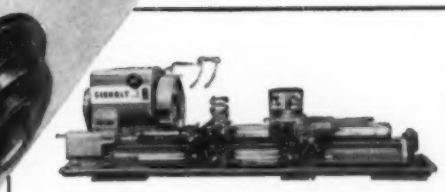
This pneumatic marking machine impresses a deep mark on tough metal surfaces without exerting extreme pressures and shock.

Keeping the control switch at the side of the machine at "reciprocating position," the operator depresses the pedal which brings the table holding the part into marking position. After a timed interval (normally a fraction of a second) the head automatically passes the marking die back and forth on the part until the pedal is released.

James H. Matthews & Co., 3962 Forbes St., Pittsburgh 13, Pa.

RUGGED POWER

Silky Smooth



GISHOLT

Saddle Type Turret Lathes

Here's how modern Gisholts are geared for greater production—to deliver smooth, vibrationless power—instantly responsive—dependable for years to come. Note these outstanding features:

1 *Gears* . . . Husky headstock gearing will carry all the horsepower and all the load of today's tools, as well as that of the foreseeable future. Rigidity is complete from the massive headstock casting right through to the ground teeth in each gear.

2 *Clutches* . . . Warner Electric Clutches inside the drive pulley do all forward and reverse driving, as well as inching and braking. They never need adjustment and give the smoothest acceleration and braking power ever put on a turret lathe. Instant HI-LO speed changes are obtained at the touch of a finger through hydraulically operated multiple disc clutches.

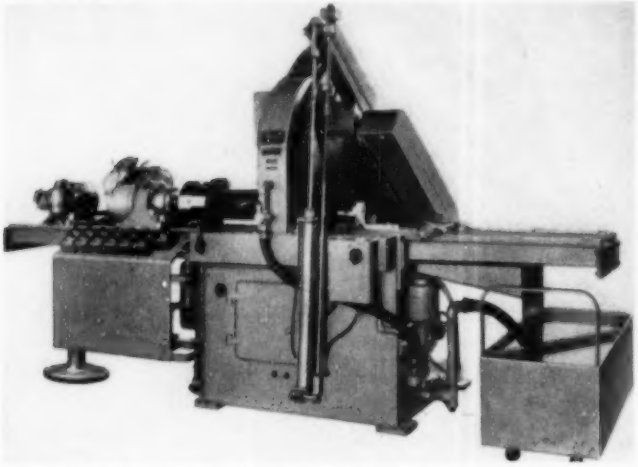
3 *Bearings* . . . Two precision tapered roller bearings at the front of the spindle, together with the precision ball bearing at the rear, carry all the radial and thrust load you can give them.

Why not get all the facts? A new bulletin on Gisholt 3L, 4L, 5L Saddle Type Turret Lathes is just off the press. Write for it.

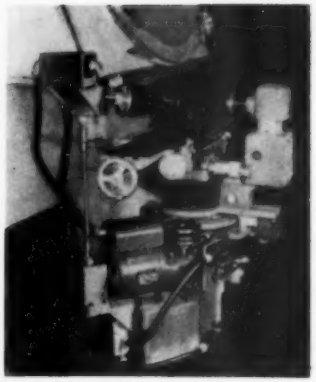
GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

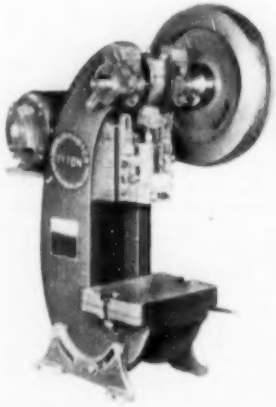


WET-ABRASIVE CUTTING MACHINE is a revolving work-bar model with oscillating abrasive cutting wheel, hydraulic wheel feed, and hydraulic work clamps. Known as the Model 508, it will cut round solid bars up to 8 in. diameter, and tubing up to 8 in. OD, either ferrous, non-ferrous or plastic materials, including corrosion resisting as well as hardened or annealed steel. Temperature of work is controlled by proper distribution of coolant. All solids or tubing are cut with minimum burr. — *Campbell Machine Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn.*



TRACING ATTACHMENT for optical comparators is used for inspecting surfaces that cannot be projected or reflected. It is shown here inspecting a component of an automatic transmission. — *Jones & Lamson Machine Co., Springfield, Vermont.*

ELECTRONIC CALIPER GAGE has adjustable measuring pressure for in-the-machine measurements. Also on exhibition at the show will be the Brown & Sharpe Intrimik—a new internal tripoint micrometer. It measures bore and hole sizes to 0.0001 or 0.0002 in., depending upon size, and a range of from 0.275 to 4.000 in. — *Browne & Sharpe Mfg. Co., Providence 1, R. I.*



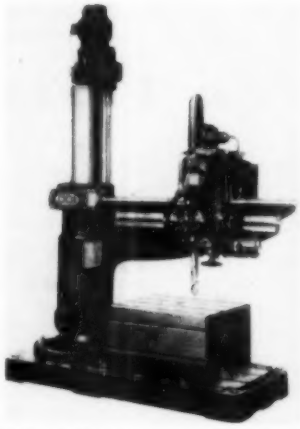
7½-ton Punch Press Added to Benchmaster Line

The 7½-ton punch press, which has been added to the Benchmaster line, has been designed to cover the widest possible range of press uses. Shut height has been increased to 9 in. (ram up, to bed). This oversized die capacity in no way hampers the use of standard-size die sets, but is said to give almost 200% more vertical die space.

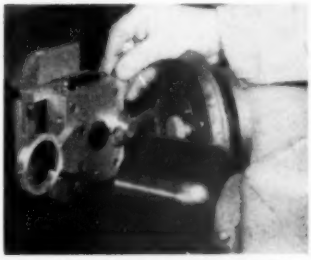
The ram has been equipped with a 1 9/16-in. dia shank hole, which lends itself to interchangeability with a wider range of applications.

Standard stroke is 1¼ in., with special lengths up to 2½ in. Four hardened striking pins are mounted on the fly wheel.

Benchmaster Mfg. Co., 1835 West Rosecrans Avenue, Gardena, California.



RADIAL DRILL features centralized controls, extreme rigidity, and ease of operation. Both the head and arm are supported on roller bearings. Imported by: — *Tri-State Machinery Co., 3041 W. Liberty Ave., P. O. Box 8051, Pittsburgh 16.*



POWER ELEVATION ATTACHMENT for optical comparator is a self-contained motor drive unit which will raise or lower the work table faster than it can be positioned by hand, and thus increase convenience of operation. — *Jones & Lamson Machine Co., Springfield, Vermont.*

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 HYDRAULIC PRESSES—*E. W. Bliss Co., Canton, Ohio.* 32-page catalog illustrates and describes Hydro-Dynamic presses. It includes sections on single-action, drawing and open-end presses, special function presses, materials-handling devices, and hydraulic cushions.

2 FORM-GRINDERS—*The Sheffield Corp., Dayton 1, Ohio.* 8-page bulletin deals with Micro-Form grinders used in grinding both circular and flat form tools, templets, profile gages, cams, dies, etc., from hardened materials. They use a pantograph and viewing screens.

3 UNDERDRIVE PRESSES—*Denly Machine Specialties, Inc., Chicago, Ill.* 16-page catalog describes single, double, and triple-action underdrive presses. Specifications and explanations of operating features are included.

4 GEAR DEBURRER — *The Sheffield Corp., Dayton 1, Ohio.* 8-page catalog illustrates and describes a deburring machine used on external gears—spur, helical, hypoid, and bevel—as well as multiple-start worms.

5 ABRASIVE-BELT MACHINES — *The Porter-Cable Machine Co., Syracuse 1, N. Y.* 32-page case-ready booklet describes in general terms the advantages of abrasive-belt machining.

6 BAND SAW — *The Doall Co., Des Plaines, Ill.* 16-page brochure covers the Contourmatic, a hydraulically operated model. Various techniques are described such as: friction cutting, hand filing, polishing, high-speed sawing, etc.

7 FACE GRINDER—*Samuel C. Rogers & Co., Buffalo 11, N. Y.* 6-page pamphlet describes operation of the massive Series-824 heavy-duty blade grinder.

8 PRESS BRAKES — *Verson Allsteel Press Co., Chicago 50, Ill.* 32-page catalog gives design details and specifications on the complete line of Verson press brakes with capacities from 15 ton up.

9 DOUBLE RIVET SETTER—*Chicago Rivet and Machine Co., Bellwood, Ill.* 8-page pamphlet illustrates and describes a new double rivet setter, with pneumatic control, that gives an operator the choice of two sets of riveting centers.

10 FOREIGN MACHINES—*Foreign Machine Co., Inc., Brooklyn 32, N. Y.* 12-page catalog carries a complete description and photos on: imported engine lathes, boring mills, milling machines, drill presses, radial drills, shapers, grinders, etc.

TOOLS AND ACCESSORIES

11 GRINDERS - MILLERS — *Precise Products Co., Racine 1, Wis.* Large 16-mead catalog shows grinder-millers, mounts, accessories, rotary tools, operating instructions, parts lists, and outline drawings of the various models.

12 GAGE BLOCKS—*The Doall Co., Des Plaines, Ill.* 24-page catalog on gage blocks and gage accessories shows typical uses, describes the calibration service, etc.

13 MAGNETIC GAGES—*Pratt & Whitney Div., Niles-Bement-Pond Co., W. Hartford 1, Conn.* 6-page bulletin illustrates and describes "magnetic" continuous gages that will show any variations of thickness down to 0.0001 in.

14 DIE SETS—*Denly Machine Specialties, Inc., Chicago, Ill.* 12-page booklet presents the tooling advantages, in both time and cost reductions, offered by precision die sets.

15 PORTABLE TOOLS — *The Buzor Tool Co., Cleveland 16, Ohio.* 12-page booklet has maintenance, application, and safety comments about 100- and 200-watt electric portable tools.

16 SAFETY VISES—*Pivot-Lock Corp., Div. of American Machine & Foundry Co., Bloomfield, N. J.* Pivot-Lock vises prevent saw or drill breakage and insure the operator's safety. 4-page bulletin illustrates and describes them. They are for hand saws or drill presses.

17 COLLETMANDREL — *E. Washburn Corp., 109 Boley Ave., Syracuse 11, N. Y.* A one-piece tool that grips the work from the inside surface is described in this four-page bulletin.

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18 DIAMOND LAPPING COMPOUND —*Penn Scientific Products Co., Philadelphia 44, Pa.* 4-page bulletin illustrates and describes diamond lapping compound in 12 grit sizes and two forms—oil and lube.

19 CUT-OFF TOOLS — *Anthony Tool Co., San Antonio, Tex.* 6-page illustrated folder of cutting-off tools for lathes. Describes types, applications, sizes and composition. Includes prices.

20 DIAMOND WHEELS—*Norton Co., Worcester 6, Mass.* 12-page illustrated booklet of "Do's and Don'ts" for lengthening the life of diamond wheels for grinding carbide tools.

WELDING AND HEAT-TREATING

21 THERMOSWITCHES—*Fenwal Inc., Ashland, Mass.* 32-page illustrated catalog covering the design, operating characteristics and installation of 10 thermostatic and 5 basic thermostatic devices.

22 TIME-TEMPERATURE CONTROL —*Bryan Instruments Div., Stromberg-Carlson Regulator Co., Philadelphia 44, Pa.* 16-page illustrated catalog describing new programmer thermometers as time-temperature controls. Gives uses, advantages and operation.

23 INDUSTRIAL FREEZERS—*Industrial Div., Walker Appliance Co., Inc., Indianapolis 6, Ind.* 4-page illustrated folder describing 48 standard model mechanical freezers in varied capacities and temperature production.

24 NON-FUSION WELDING—*Syntectic Welding Alloys Corp., Pleasing, N. Y.* 6-page illustrated reprint of technical paper, "Diffusion and Diffusion Aspects of Non-Fusion Welding." Includes charts, diagrams, tables, and formulas derivations.

25 WELDING PRODUCTS — *Ampco Metal, Inc., Milwaukee 46, Wis.* A colored wall chart listing all Ampco bronze welded and wire products. Gives AWS-ASTM designation, descriptive information, properties, and applications, etc.

PLANT-SERVICE EQUIPMENT

26 OSCILLATING CONVEYORS — *Link-Belt Co., Chicago 1, Ill.* 24-page illustrated booklet on positive-action oscillating conveyors. Includes dimensions, troughs, and capacity and hp charts.

27 DUST COLLECTORS — *Trent Mfg. Co., St. Paul, Minn.* 16-page illustrated catalog describing a complete line of dust collectors. Gives sizes, models, applications.

28 ELEVATING TABLES—*The Raymond Corp., Greene, N. Y.* 4-page illustrated folder on a line of hydraulic work tables for die handling or work positioning. Includes construction, capacities, etc.

29 VAPOR COLLECTORS — *Aget-Detroit Co., Ann Arbor, Mich.* 6-page illustrated bulletin on the control of vapor, mist and fog in wet-machining operations through the use of unit collectors. Describes models and applications.

30 IMPREGNATING SYSTEMS—*Precision Instrument Engineers, Inc., Pittsburgh, Pa.* 6-page illustrated bulletin on the company's vacuum-pressure impregnating equipment. Describes system and explains its operation.

31 CRANE TRUCKS—*Fisher Industrial Truck Div., Baker-Raulang Co., Cleveland 6, Ohio.* 4-page illustrated folder describing two models of locomotive crane trucks. Gives construction features, capacities and specifications.

32 POWER STACKERS—*Industrial Engineering & Mfg. Co., Inc., Brookfield, Ind.* 4-page illustrated folder of information on a universal power booster and stacker. Includes specifications.

33 FANS AND BLOWERS—*Standard Electric Mfg. Co., West Berlin, N. J.* 84-page illustrated catalog describing a line of fans, air circulators, exhaust fans for office and industry.

34 INDUSTRIAL LIGHTING — *Lamp Div., General Electric Co., Cleveland, Ohio.* Group of five 4-page illustrated bulletins, "See Better-Work Better." Shows good lighting applications in various industries.

35 LIFT TRUCKS — *Barrett-Cravens Co., Chicago 8, Ill.* 4-page illustrated folder of information on line of single-mast fork-lift trucks. Includes specifications on models with capacities up to 4000 lb.

PARTS AND MATERIALS

36 TOOL STEEL—*Allegheny Ludlum Steel Corp., Pittsburgh 22, Pa.* 192-page illustrated book on tool, die, and allied steels. Contains technical information for designers, engineers and metallurgists. Includes detailed descriptions of important grades, tables, reference data, etc. Use coupon letterhead.

37 INSTRUMENT TRANSFORMERS—*General Electric Co., Schenectady 5, N. Y.* 64-page illustrated guide for instrument transformer buyers. Gives ratings, classifications and prices of all G-E transformers and metering outfits. Uses tables to cover mechanical and thermal limits.

38 PRESSURE PILOTS—*Brown Instrument Div., Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.* 8-page illustrated catalog on a non-indicating pressure controller. Covers principle of operation, specifications, and other pertinent information.

39 MOTOR APPLICATION — *Electric Machinery Mfg. Co., Minneapolis 12, Minn.* 12-page technical paper on "Application of Direct-Connected Synchronous Motors to Reciprocating Compressors."

40 BEARING MAINTENANCE—*Anti-Friction Bearing Distributors Association, Cleveland, Ohio.* Group of eight illustrated reports on bearing maintenance. Gives symptoms, causes and corrections for many applications.

41 AIRCRAFT CABLE—*Macwhyte Co., Kenosha, Wis.* Illustrated catalog covering line of aircraft cable, terminals and assemblies, listed in conformance with military specifications.

42 INDUSTRIAL SPRINGS—*Sandvik Spring Div., Sandvik Steel, Inc., New York, N. Y.* 16-page illustrated brochure of technical information on using flat springs as a power source.

43 FAN-COOLED MOTORS — *Allis-Chalmers Mfg. Co., Milwaukee, Wis.* 8-page illustrated folder of construction features and details on a line of totally enclosed, fan-cooled motors.

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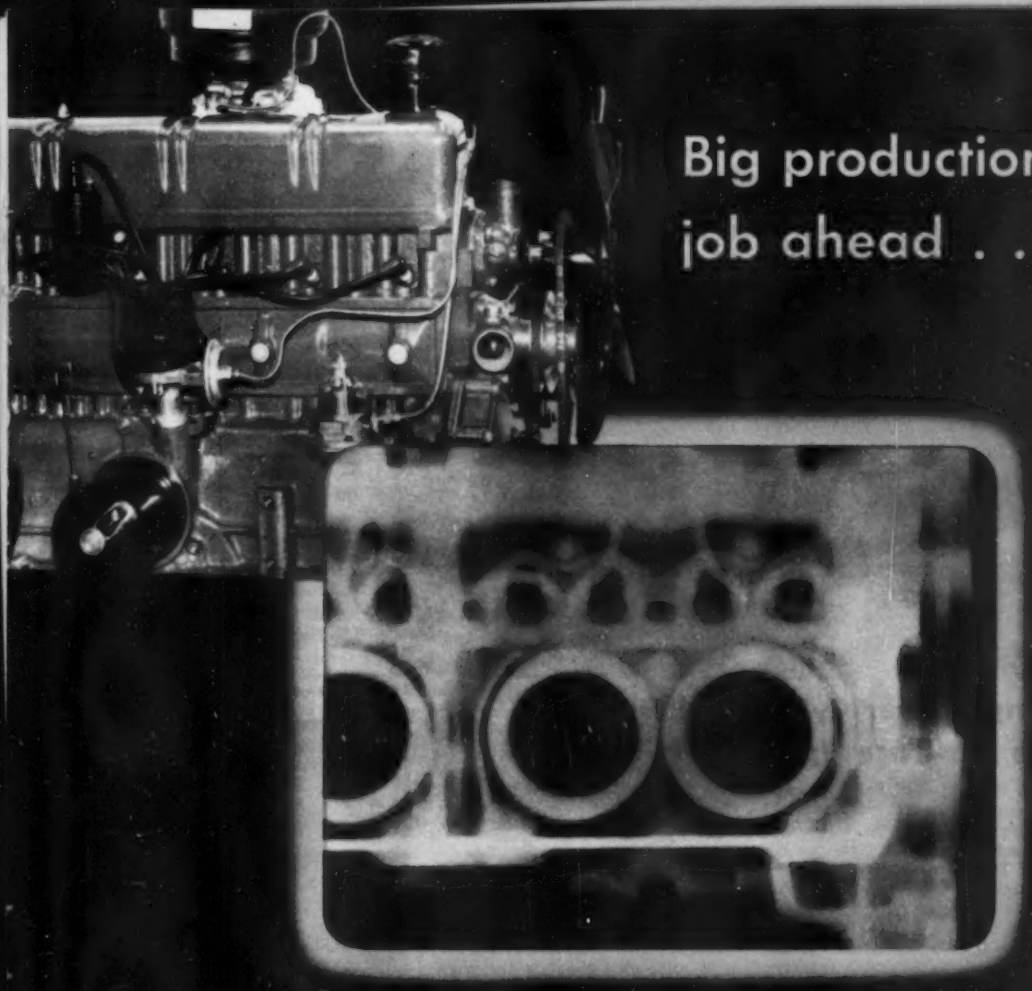

RADIOGRAPHY checks procedure

Here you see a radiograph of a car engine block. It was a new design—almost ready for production. It was important that it be sound, free from sand or gas holes—and with no core shifts.

To be sure, pilot castings were radiographed. It was the one way to know these internal conditions without destroying the casting.

More and more foundries are making radiography a routine procedure. It is the way to be sure only high-quality work is released. In production runs it indicates ways in which methods can be improved and yield increased.

If you would like to know how radiography could improve your plant operation, talk it over with your x-ray dealer. Also, if you wish, we'll send you a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

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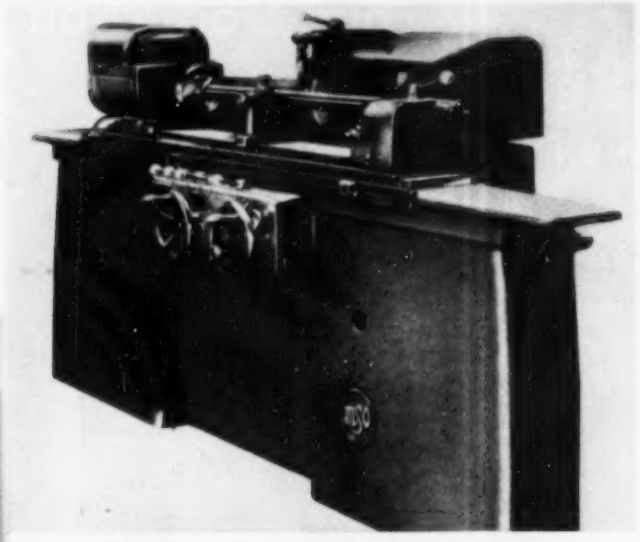
TRADE-MARK



Klingelhofer Cylindrical Grinders Are Accurate Up to 40 Millionths

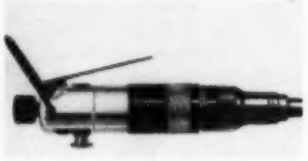
A new line of infeed grinders, made in Germany, can do longitudinal grinding with hand or power infeed and have quick return traverse of the wheelhead controlled by an adjustment of the main operating lever. Control of plunge-cutting is through a deferring relay, which stops work and coolant after spark-out and returns by quick traverse.

An electrical size-grinding device plunge-cuts, automatically disengaging the table and stopping the coolant and work rotation when the work is on size.

Normal accuracy of the machine is to a tenth, but a hand controlled vernier adjustment permits closer work.

A second grinder is for surface work. Accuracy is normally to five tenths, but the same vernier adjustment permits cuts to be taken to 50 millionths. A "Micro-Jog" feature allows inching the wheel exactly 50 millionths closer to the work when a button is pressed. The mechanism for this operation is glass-enclosed, sealed, and electrically powered.

Albert Klingelhofer Machine Tool Corp., Westfield, N. J.



Screwdrivers and Nutsetters Have Built-in Speed Regulators

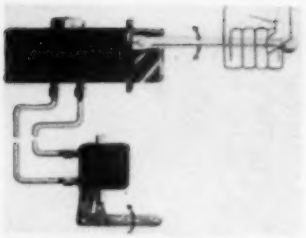
Reversible screwdrivers and nutsetters are available from Aro Equipment Corp. in two models, one with an adjustable clutch, the other with a positive clutch. A push-type reverse valve used on the unit allows for instantaneous reversing, and permits the operator to keep one hand always free.

The adjustable clutch model can be pre-set to correct torque requirements. Clutch jaws automatically disengage when screw is set to desired tension. It uses a built-in regulator and can be easily converted to a nutsetter.

All tools are equipped with ¼-in. hex head holder, ⅛-in. air inlet. A bit, a finder and wrenches for adjustable clutch tool and suspension bail are furnished as standard equipment.

Optional equipment includes choice of any bit and finder, or guide and square-drive adapter and socket.

Aro Equipment Corp., Bryan, Ohio.

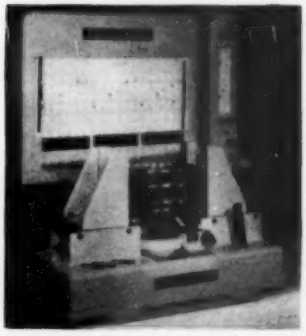


Hydraulic Remote-Control Unit

This hydraulic remote-control unit is a simplified device for positioning, controlling and duplicating movement at a distance. It is said to have many applications in the product design field, including machine tools.

Chief among its features is the automatic compensation for contraction and expansion of fluid media. It operates with a smooth, sensitive stroke.

Superdraulic Corp., 142-56 Wyoming Avenue, Detroit, Mich.



Gage Measures Jet-Blade Contours At Up to 26 Points

The Sheffield jet-engine-blade contour gage checks 18 to 26 or more points simultaneously. It has many advantages including: rapid and accurate measurements; ease of reading; flexibility and adaptability to a wide range of blades; and means of adjusting or positioning the blade in gaging position. It can be adjusted for use with either the widest or narrowest tolerances specified in any plant at any phase of manufacturing jet blades.

Reading the float position pattern in the specified columns provides a means of rapidly analyzing all conditions of the jet blade such as contour, thickness, lean, tilt, warp and centrality.

Sheffield Corp., Dayton 1, Ohio.

Century

Serves the Electric Motor User in Two Important Ways:

1. Century motors are designed and constructed for a long, dependable operating life.

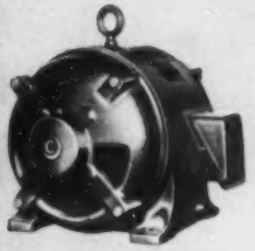
2. Just as important—they are skillfully selected to match the operating characteristics of the many kinds of equipment they drive.

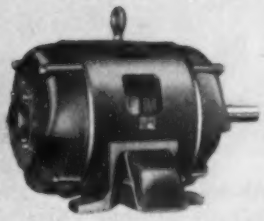
IN CENTURY'S wide range of types and sizes (up to 400 H.P.) there are available: 4 standard classes of starting torque characteristics—6 methods of speed control—constant and short time ratings—4 basic classes of frame protection against atmospheric hazards—a dozen methods of mounting the motor to the equipment—plus many special specifications to meet the requirements of the BIG NAME equipment manufacturers who use Century motors as a component part of their equipment.

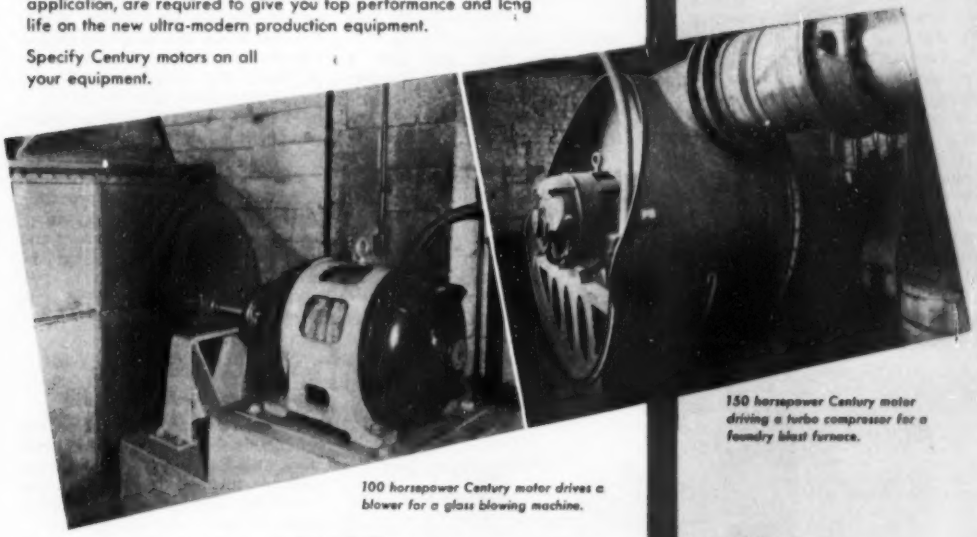
Teamwork with equipment producers gives you skillfully selected motors from Century's wide range of types and sizes . . . properly applied to match the performance characteristics of the machines they drive.

Both a properly designed and constructed motor, plus skillful application, are required to give you top performance and long life on the new ultra-modern production equipment.

Specify Century motors on all your equipment.







100 horsepower Century motor drives a blower for a glass blowing machine.

150 horsepower Century motor driving a turbo compressor for a foundry blast furnace.

Century SERVICE Is Near Any CENTURY Motor Driven Equipment

Century Service Is Near Any Century Motor Driven Equipment. Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
2. CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.
3. Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.

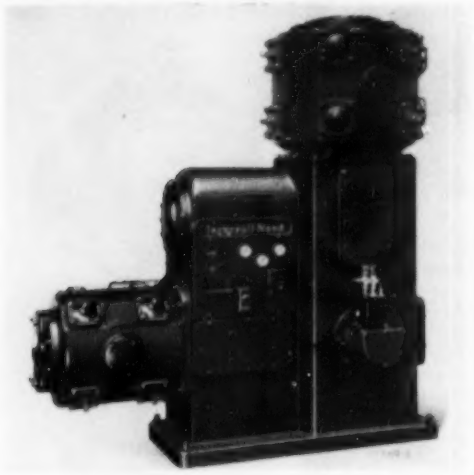
704

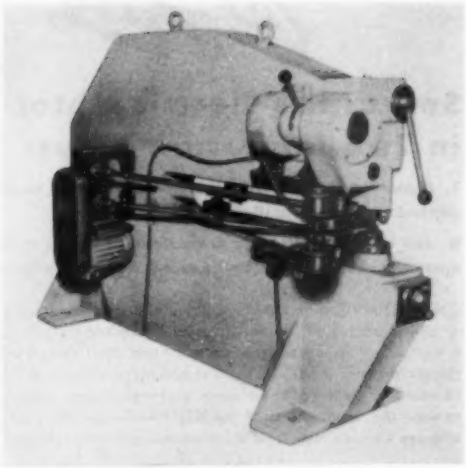
CENTURY ELECTRIC CO.

1806 Pine St. • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS





Packaged Air Compressor Eliminates Interstage Piping

Designed as the XLE, this L-design air compressor embodies a single vertical low-pressure compressor cylinder, a horizontal high-pressure cylinder, and a synchronous or induction motor mounted directly on the crankshaft. It requires only a very small foundation.

One innovation is pipeless, through-frame air flow. Air enters and leaves the compressor through main air connections on the frame instead of on cylinders, and is led to and from both cylinders and inter-cooler through large passages within the frame itself. There is no interstage piping nor cylinder strain due to air piping. The inter-cooler is of a package design requiring only one fourth the space of conventional coolers and fits entirely within the same frame.

Counterflow, tube-and-finned construction of the intercooler is said to give excellent cooling with very little pressure loss, and with a small quantity of water. It is made of all-copper alloy throughout.

All bearings in the unit are full-floating and rotate freely on the bearing journal within the rod or bearing housing. Main and crankpin bearings are of aluminum alloy. Combined with pressure lubrication in a sealed, dust-tight crankcase that need not be opened for bearing adjustment, this construction is said to result in less maintenance.

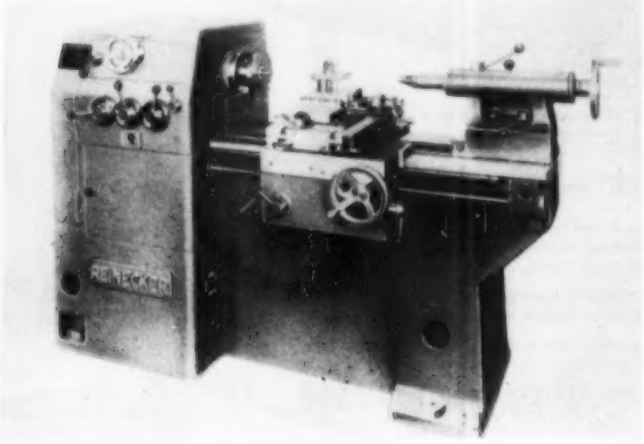
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.

Power Feed Device Added to Sheet-Working Machines

Power feed has been designed for use on the Pullmax Major, Model P-5 and Model D-3 to aid in cutting and working steel plate up to 11/32-in. thick. The device can be used for cutting disks and circles on a production basis. It is said to reduce manpower, speed up cutting time, and remove variables of vibration sometimes caused by hand feeding.

Cutting is done by a reciprocating upper tool operating with a stationary lower tool. Straight, circle, and irregular cutting, inside or outside, can be done.

American Pullmax Co., Inc., 2455 N. Sheffield Ave., Chicago 14, Ill.



Reinecker Relieving Lathe Has Tripled Operating Speed

Three groups of change gears are completely independent in the headstock of a Reinecker lathe built for back-up turning. Tool compound movements are independent of each other.

Cam control is through a large closed curve, and compound movement is tight so up to 270 passes per minute—compared with 40 to 100 in previous models—are possible. Stroke length is from zero to $\frac{5}{8}$ in. without changing cam plates.

Attachments for the lathe include a relief-grinding unit that tilts in three planes and has a built-in drive motor, and a grinding-wheel dresser.

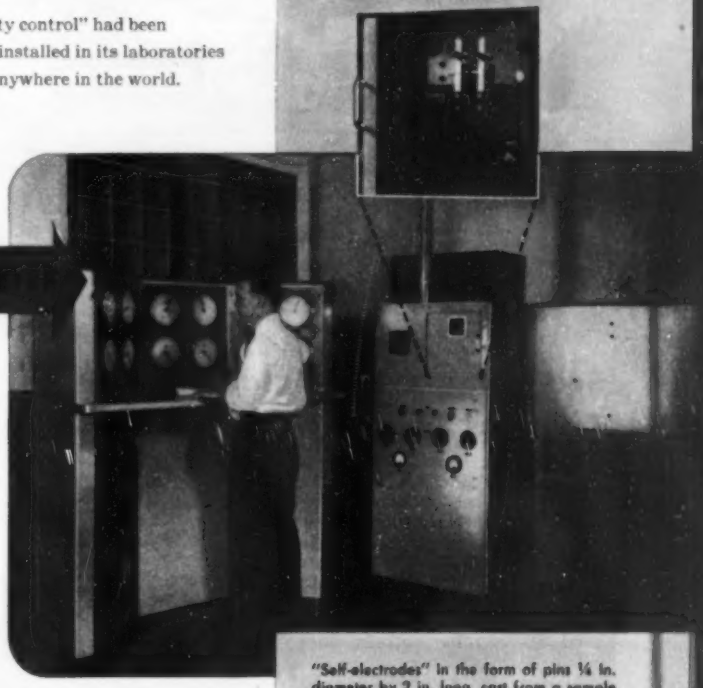
Imported by:

Kurt Orban Co., Inc., 205 E. 42nd St., N. Y., N. Y.

LEADERSHIP can't stand still

this time it advances on spectral waves

Way back in 1914, before the term "quality control" had been invented, The American Brass Company installed in its laboratories the *first* spectrograph used by industry anywhere in the world. Today, this Company, first in its field, has introduced the latest word in rapid analytical procedures, the . . .



What it does

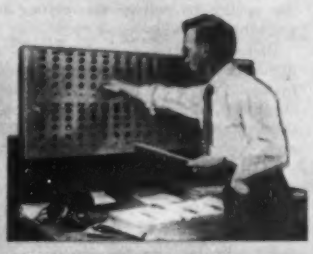
In five minutes by spectrochemical methods this instrument completes an analysis that would take several hours by spectrographic procedures and several days by the traditional methods of chemical analysis. Now an electric furnace charge of molten metal can be analyzed *before* it is poured.

What it means

This continuing leadership in the application of scientific developments to production has many practical advantages. For instance: In conserving copper and zinc by making maximum use of scrap in such an important alloy as cartridge brass. The rapid, complete analysis for metal content and impurities permits a high degree of control not otherwise possible. Thus, through the development of spectrochemical analysis you are assured of new high standards of uniformity in Anaconda Metals—unsurpassed by *any* in the industry. The American Brass Company, General Offices, Waterbury 20, Connecticut. 5287

"Self-electrodes" in the form of pins ¼ in. diameter by 2 in. long, cast from a sample of the melt to be analyzed, are accurately spaced in the electrode holders of the Baird Associates—DOW Direct Reading Spectrometer (top illustration). A button is pressed—and a 25,000-volt spark bridges the gap. Then...

Light from the spark falls on a grating and is reflected, in a separate spectrum line for each element, onto photomultiplier tubes. Seconds later, accurate, direct dial readings indicate the amount of alloying elements present and the amount of impurities, such as iron, nickel, manganese, aluminum, silicon, lead, arsenic, phosphorus and antimony.

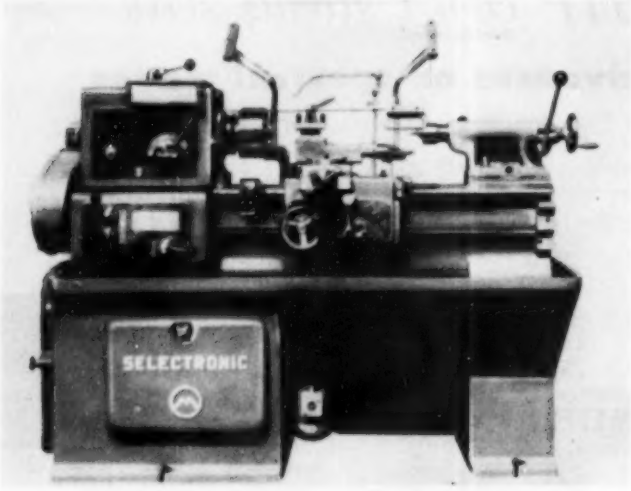


With the analysis of the melt known to be right, a "go-ahead" is flashed to the casting shop and the metal is poured.

ANACONDA

sets the pace in quality control of

COPPER and COPPER ALLOYS



Servo Motor in Belgian Lathe Changes Speeds Automatically

Small turning work is handled at high speed on an engine lathe with "Selectronic" headstock control. A servo motor that controls a speed-change mechanism is actuated by a lever on the headstock. Speeds are indicated and picked on a large slide-rule dial in the head. The driving pulley is mounted on a sleeve supported by two roller bearings resting on the headstock casing.

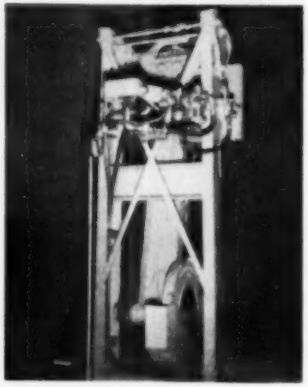
All parts are designed with simple maintenance in mind. Electrical equipment is centralized on a single panel. The front spindle bearing is adjustable for wear, and belt changes within the head are made without taking the spindle down.

A tailstock lever, in addition to the usual handwheel, controls a rack that can be operated to retract the barrel to allow fast change of work between centers. The barrel is spring-loaded in normal position, and is brought back against the spring. Releasing the lever allows the spring to return the center to working position.

Distance between centers is 22¼ in., swing is 13¾ in., motor has 6.4 hp at 1500 rpm. Spindle tapers are standard American and Morse. Spindle speeds range from 125 to 3200 rpm.

Standard equipment is normal for a high-production engine lathe. Extra equipment includes micrometer stops, coolant equipment, copying apparatus, collets, rear toolpost. An indexing toolpost is standard equipment. Imported by:

Morey Machinery Co., Inc., 410 Broome St., N. Y., N. Y.



Air-Operated Cut-Off Saw Works Automatically or Manually

This air-operated swing saw performs cut-off operations in metals, woods or plastics. Available in three models. Frame made of heavy structural duty steel, providing a factor of rigidity with an arm mounted on a heavy axle, operates on large and longer bearings.

Motor on the unit is mounted close to the fulcrum, which overcomes inertia in the momentum set up by the motor at the end of a pendulum with each stroke. The drive provides any blade speed at which an operation in various materials or with any diameter blade or wheel can be handled most efficiently. Cutting is done close to the saw arbor and uses smaller blades, heads and wheels. Rotation of the blade tends to move the arm forward requiring little effort by the operator. The three models will take either a 10-, 14- or 16-in. blade or abrasive wheels maximum dia. The cutting capacity varies from 3¾ x 6 in. for the smaller model, to 1 x 30 in. in the large model.

Speeds at standard RPM with any possible v-belt drive are 3440, 2460 or 2140.

Standard equipment consists of hood guard, rear guard, and dust chutes; V-belt guards, motor mounts, saw stop, arbor pulley, saw collars. Available as optional equipment with the units, an automatic air operating unit has been designed to further speed cut-off operation and to increase operator's productivity. The speed of the arm movement forward and return can be set to make the most cuts per hour possible or slowed to that speed required to automatically cut metals without operator's attention, so he can attend other machines.

Heston & Anderson, Division of St. Paul Foundry & Mfg. Co., Fairfield, Iowa.

Logan Toolroom Lathe Has Extra-Large Spindle

The 1100-series lathe has an extra-large headstock spindle turning on a double and a single row of ball bearings. Swing is 11 in. and collet capacity 1 in.

A draw-bar collet attachment is built in and supplied as standard equipment. A collet rack that clamps to the bed is also furnished.

The carriage cross-slide ways are finish ground and the cross-slide and compound-rest screws have thrust bearings for smooth movement. The top of the saddle is machined finished for indicator use. The compound base swivel dial has reference marks on both the left and right sides and can be easily read.

The large dials on the cross-and compound feeds measure 3 and 2¼ in. respectively, and are provided with instant adjustment.

Logan Engineering Co., Chicago 30, Ill.

Here's Proof

The New Thompson Type 2F is a

SUPER PRECISION

Tool Room Grinder

WEBBER GAGE COMPANY
12900 TRIBOLET ROAD · CLEVELAND 11, OHIO

November 10, 1950

Mr. Wilson, Vice President
Thompson Grinder Company
Springfield, Ohio

Dear Mr. Wilson:

We recently installed a new THOMPSON Tool Room Grinder to grind Gage Blocks to our specifications and tolerances. The results have been very satisfactory, in spite of the close limits to which the work has to be done. We thought you would be interested in the performance of this machine.

Very truly yours,
WEBBER GAGE COMPANY

Thompson 2F Grinder Photographed in the Webber Gage Co., Cleveland Plant

COMPARE THIS NEW
8 x 10 x 24
TOOL ROOM GRINDER

When working to a tolerance of four millionths of an inch such as is observed when making Webber Gage Blocks, the rough or preliminary grinding plays an important role in keeping cost of the final finishing within reasonable limits.

Compare These Features:

- HARDENED AND GROUND cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- HARDENED AND GROUND sealed anti-friction vertical slide.
- HARDENED AND GROUND BED WAYS with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.

Handy control panel.

- Elevation micrometer stop graduated in .0001".
- GROUND THREAD FEED SCREW.
- Automatic wheel TRUING device.
- Longitudinal hand wheel with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".
- GROUND THREAD FEED SCREW.

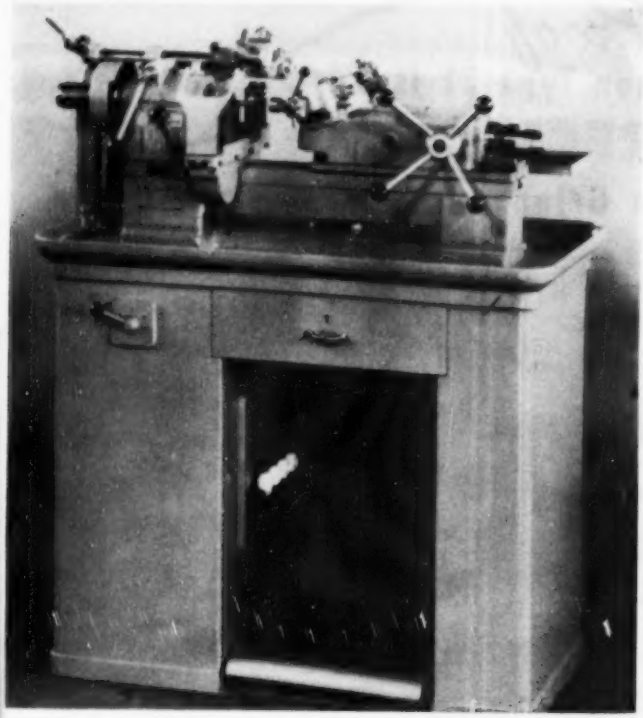
WRITE TODAY for complete specifications and performance data. Address Dept. 16, Thompson Grinder Co., Springfield, Ohio.

COPYRIGHT 1951 BY THE THOMPSON GRINDER CO.

The only manufacturer of a complete range of heavy duty and light duty surface and contour grinders for industry.

Thompson SURFACE Grinders

The Thompson Grinder Company, Springfield, Ohio



Spindle Instantly Reversed by Pedal On German Hand Turret Lathe

The motor on this Kuhlman lathe is of the two-speed type and can be instantly reversed by actuating a pedal. This is a desirable feature on tapping operations.

Twelve spindle speeds from 156 to 8000 rpm are available. Coolant pump, with motor and piping, tool shelf, blue-print holder, machine light and complete electrical equipment are standard equipment.

The self-indexing turret has six stations with ⅝-in. bores. Three, four, five, or six stations can be automatically indexed per revolution of the turret head. The turret slide is long, allowing clearance for protruding tools and holders. The headstock has a quick-action lever. With the one lever all working controls are actuated.

The collet is opened and closed, the motor is started and stopped, and the spindle brake is applied through the lever. A cut-off and forming slide complete the equipment.

Imported by:

Eric R. Bachmann, 27-11—41st Ave., Long Island City 1, N. Y.

German Turret Lathe

Length of Bed	32½ in.
Height of Centers	4 in.
Maximum Collet Capacity	19/32 in.
Spindle Bore	25/32 in.
Maximum Turning Length	3 in.
Tool-Shank Diameter	25/32 in.

The Model-ER15E turret lathe has a sturdy sheet-steel base suitable for operation in a standing or sitting position.

The turret is horizontally tilted and is rigidly locked in each of its six working positions, for each of which a longitudinal stop can be accurately set. The turret slide is mounted on ball bearings and is protected against dust and chips. The cross slide has a front and rear toolpost which can be in the form of multiple toolholders to hold form tools. Stops for it can be easily and accurately set. The headstock, with single pulley drive, has built-in automatic bar feed. The feed and collet locking are done by a single lever.

Coolant equipment and bar stands are supplied as required.

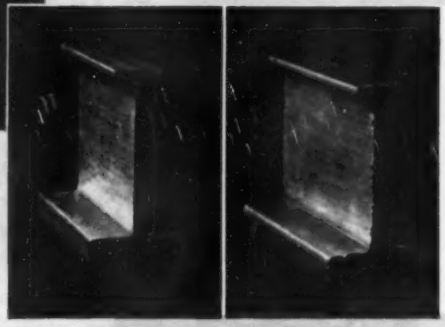
Imported by:

Guthery Machine Tool Corp., 130 W. 42nd St., New York 18, N. Y.

NEW! Johnson's STIK-WAX

An entirely new kind of lubricant that

outperforms grease sticks, tallow, bar soaps!



Sawed sections of aluminum extrusion. Left: section sawed with Johnson's No. 140 Stik-Wax is burr-free. Right: section sawed with grease stick shows bad burr.

On grinders
Stik-Wax lubricates to reduce heat—wheel clogging.

On belt sanders
Stik-Wax lubricates to give better finish—longer belt life.

On taps
Stik-Wax lubricates to cut smoother threads — increase life of taps.

On band or circle saws
Stik-Wax lubricates to lengthen blade life —gives smoother cuts —reduces burns.

Johnson's No. 140 Stik-Wax is the new wax lubricant that outperforms grease sticks, tallow, bar soaps. Saves materials and tools . . . saves time . . . produces higher quality work.

Exhaustive tests have shown that the performance of Johnson's No. 140 Stik-Wax far exceeds that of ordinary lubricants for drilling, grinding, sawing, tapping, spinning and pipe cutting. Taps and drills last far longer. Saws and cutters need sharpening much less frequently. Sanding belts and disks get added life . . . give cleaner, smoother finishes.

Applied manually or automatically, there is no end to the metal working lubricating jobs that Stik-Wax will do *better* to *speed* jobs . . . *add life* to equipment.

A product of JOHNSON'S WAX Research

Test STIK-WAX in your plant— **FREE!**

Industrial Products Dept. AM3-3
S. C. Johnson & Son, Inc.
Racine, Wisconsin

Please send free sample of Stik-Wax for testing . . . also send complete information and instructions for use.

Name _____ Title _____

Organization _____

Address _____

City _____ State _____

Beckett Tapping-Drilling Units Are Air-Controlled

Beckett air-controlled tapping-drilling machines are able to perform single and multiple tapping direct from the drill chuck or standard multiple drill head, without employing leadscrews, clutches or tapping heads. Absolute and precise control of air power is used to feed the tap through the work.

A dual air-cylinder transmission, located vertically on either side of the quill housing, provides direct thrust to the spindle.

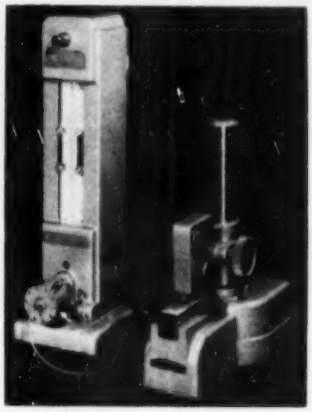
Very light air pressure is used for tapping operation, which permits the tap to form their own lead. There is no forcing of the tap and no galling action results. All the tap does is cut. It doesn't cause clutches to be engaged, thereby putting pressure on the ground lands of the tap, causing it to become dull and cut oversize threads. Less than 10-psi. air pressure is adequate for normal tapping work. When the pre-determined depth of stroke is reached, the spindle starts to ascend at the same instant the motor is reversed. The taps lead out without stripping the last thread.

The machines will produce Class 2 and 3 threads in materials such as magnesium, aluminum, brass, mild steel, hard steel, and stainless. Drilling operations are performed by removing the taps, inserting drills and switching out the motor-reversing circuit.

Units are manufactured in 15-in. capacity single-spindle bench and floor models and in multiple-spindle types having two or three heads mounted on table; 20-in.-capacity models are available in single-spindle floor models (illustrated) and in multiple-spindle units having two, three or four heads mounted on table.

Stroke on the single spindle 15-in. unit is 3½ in. Stroke on the 20-in. unit is 4½ in. A 20-in. unit operating on an 80 lb air line will provide any desired drill point pressure up to 784 lb of thrust. A 15-in. unit operating on an 80-lb air line will provide up to 302-lb drill-point thrust. Speed of stroke is infinitely variable and operation can be either fully automatic or single cycle. For setting up a job, manual pushbutton operation is used.

Beckett-Harcum Co., Inc., Wilmington, Ohio.



Gage-Block Comparator Measures By Air

The Sheffield Precisionaire gage-block comparator is said to offer an ideal means of measuring thickness of precision gage blocks by air. There is no gage point contact—the only pressure exerted on the block is that of a stream of air flowing from the jets across the upper and lower surfaces. It also eliminates the necessity of wringing the gage block to the anvil. No distortions are set up before or during the gaging operation.

The unit consists of two elements, a gage block comparator and a column Precisionaire of the desired amplification.

Accuracy of comparison is about the same as that yielded by wringing the test block and master block beside each other on an optical flat and reading approximately monochromatic interference fringes produced by super-imposing another optical flat. Greater accuracy of comparison can be had only with an interferometer type of interference comparator.

Sheffield Corp., Dayton 1, Ohio.

Automatic Equipment Inspects, Sorts, and Tabulates

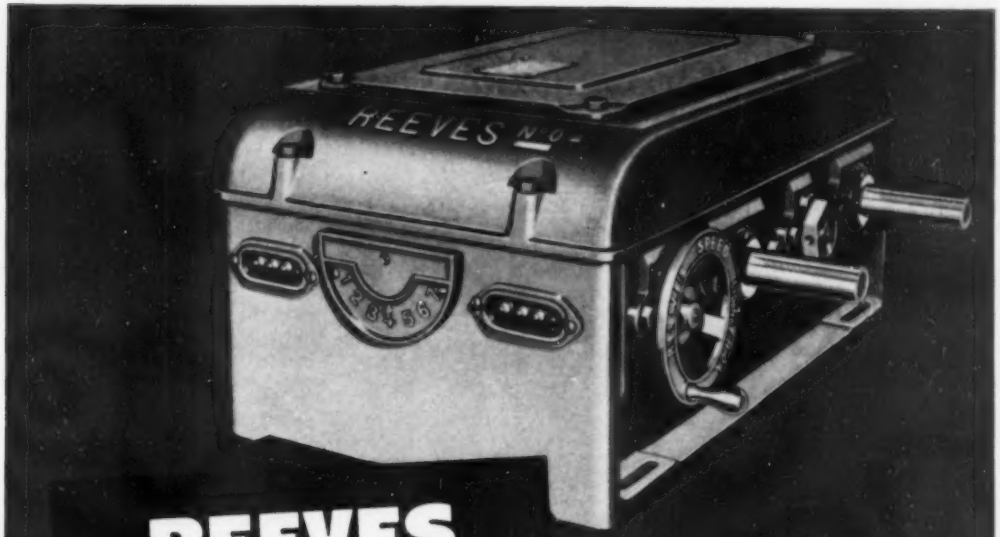
The Sigma fully automatic inspection, sorting and tabulating machine was designed to inspect any part for internal or external direct dimensions. Parts are fed into the machine automatically, where they are inspected on all dimensions simultaneously and are then discharged from the machine on to a conveyor belt, divided into accepted, rejected and rectifiable pieces.

A tabulating box records the number of times pieces are plus and minus for size on each dimension, also the number of accepted pieces and total pieces.

The rate of inspection obtainable on this machine is up to 3600 pieces per hr. It can be changed over to inspect a difference piece in 20 minutes. Other models are available giving smaller or larger rates of inspection. It is said to eliminate the labor and fatigue associated with inspection of many parts and insures a constant supply of 100% inspected pieces to the assembly line. It requires only one operator.

In the illustration, the machine is tooled up to inspect 11 dimensions on a 20-mm. shell. Imported by:

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.



REEVES Variable Speed Transmission

The original mechanically correct unit for providing complete, stepless speed adjustability

Industry's most widely used unit for adjusting machine speeds . . . for all these good reasons:

1. Incorporates the REEVES operating principle—proved in 300,000 installations—which assures *accurate, positive* delivery of any desired speed within the entire speed range, without stopping the machine.

2. Makes "changeovers" easier—utilizes the machine's *full* capacity—by providing the *right* speed—with the turn of handwheel or touch of button—for every operation and every operator, under every changing condition.

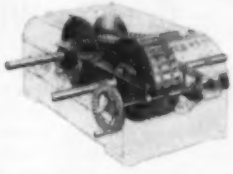
3. Wide choice of vertical and horizontal models—capacities up to 87 hp; in speed ratios of 2:1 to 16:1; manual, electric, hydraulic or completely automatic controls; suitable for mounting in any position. Also "Internals" for mounting within machine framework.

4. Easily installed on your machines. Ruggedly constructed with few moving parts subject to wear . . . requires no special tools or training to maintain.

5. Used on more different kinds of machines in a greater variety of industries than any other single variable speed drive.

Profit from REEVES Speed Control in your plant—*see immediate results.* Send for full details on REEVES Speed Control—ask for catalog No. A 68a-G.

Operating Principle



REEVES Variable Speed Transmission embodies the proved operating principle of a V-belt driving between two pairs of cone-shaped discs, mounted on parallel shafts and adjustable to form an infinite number of driving and driven diameters. One shaft receives power at constant speed from motor, line shaft, etc. Other shaft delivers power at infinitely variable speeds to driven machine. Each speed setting is held without fluctuation. Operation is practically noiseless.

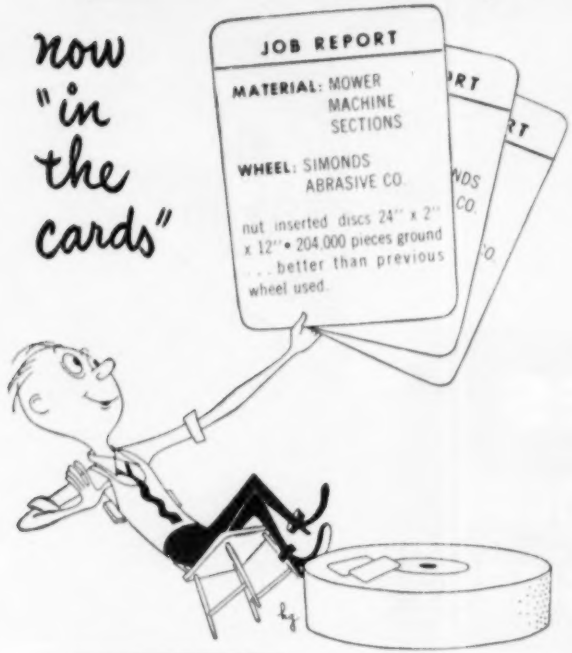
REEVES PULLEY COMPANY · COLUMBUS, INDIANA

Recognized leader in the specialized field of speed control engineering

accurate · variable
REEVES *Speed Control*

Better disc grinding

now "in the cards"


JOB REPORT
MATERIAL: MOWER MACHINE SECTIONS
WHEEL: SIMONDS ABRASIVE CO.
nut inserted discs 24" x 2" x 12" • 204,000 pieces ground . . . better than previous wheel used.

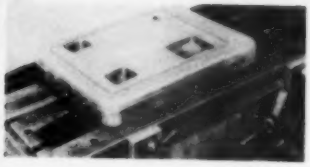
SIMONDS ABRASIVE CO.

Grinding Wheels

Take the gamble out of grinding wheel selection. Deal yourself in on top grinding performance with Simonds Abrasive Company Grinding Wheels. Complete line includes wheels of every combination of grain, grade and structure . . . wheels of all shapes and sizes . . . mounted wheels and points, segments and abrasive grains . . . industrially proved production tools backed by Simonds Abrasive Company complete quality control, expert engineering service, and 60 years experience as one of the nation's leading manufacturers of grinding wheels. Send now for free data book. Also the name of your Simonds Abrasive Company distributor.

SIMONDS ABRASIVE CO. PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

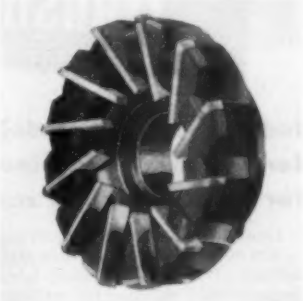


Planer Jaw Clamps Have 45° Action

"Jumbo" and "Lil-Giant" clamps for planer tables of any size have compound action, forcing the work down on the table, and across toward opposite clamps on the other side of the work. One adjusting screw clamps or releases each holder.

On production runs, half the clamps can be released while the others are left in place because the clamps center the work automatically. Clamp parts are all hardened. The "Jumbo" type is 1½ in. high by 6½ in. long by 2½ in. wide. "Lil-Giants" are 1¼ by 5½ by 2 in. All have T-nuts for planer tables, and can be fitted with various noses.

J & S Tool Co., E. Orange, N. J.



Kennamill Milling Cutter For Intermittent or Narrow Cuts

The Style KF Kennamill is designed primarily for steel production milling runs where adequate horsepower is available, and where intermittent or narrow cuts are encountered.

The cutter has only four different parts: Body, blades, wedges, and nuts. Stud-type wedges and screws are one-piece high-alloy steel, hardened and ground to close tolerances. They remain assembled to the cutter body at all times, thus reducing the possibility of lost parts.

The blades are heavy, solid, wedged-in—no brazing strains. No hammers or special tools are needed

SEE THIS COMPLETE LINE OF SUPER CARBIDE TOOLS AT THE A.S.T.E. SHOW

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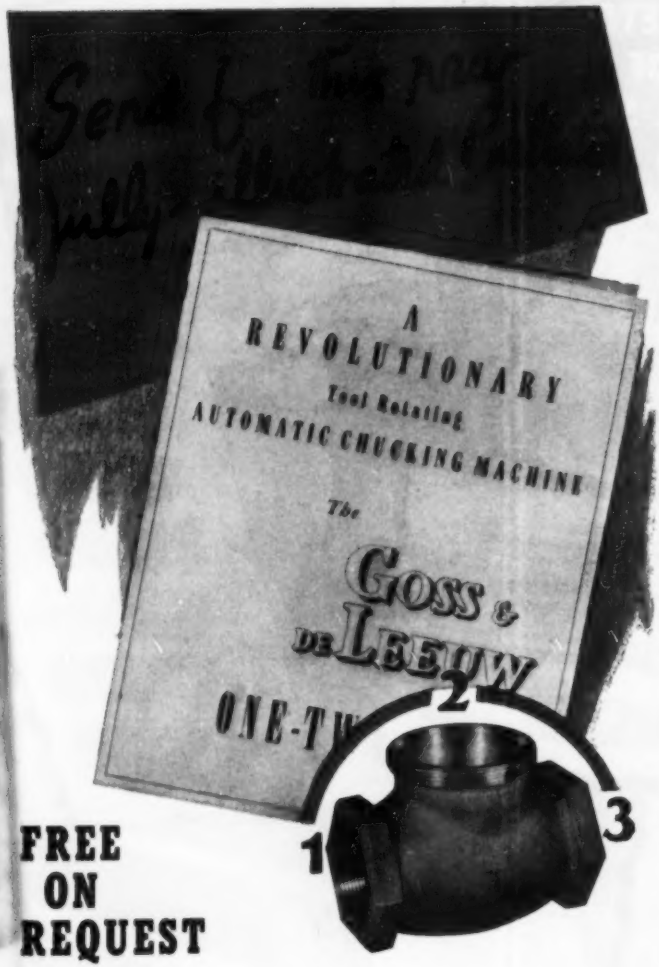
Booth 1429

Super
TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California



FREE ON REQUEST

Here are the answers to most of your questions as to what "ONE-TWO-THREE" means in describing this outstanding development of Automatic Chucking Machines by Goss and De Leeuw. You'll be interested not only in the revolutionary design of the machine itself, but also in its extraordinary performance—and how it is possible to handle from one to three operations—in sequence or simultaneously without changing set up.

Get this interesting, informative Bulletin NOW—by merely asking for it.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

to tighten them — a simple hex wrench is sufficient.

Blades are interchangeable in all slots of any size of cutter body of the same type. Wedges are round and are interchangeable in any slot of any size cutter, either right- or left-hand. They do not have to be pried out, but can be loosened with a soft hammer.

Other features of this cutter include: (a) Mountable on any common spindle; (b) Heavy construction and great rigidity; (c) Ample wedge clamping area; (d) No threads in body to strip out; (e) Adequate wedge-width tolerance to allow for wear on the wedge and cutter-body blade-slot wall; (f) Chip clearance for heaviest cuts; (g) Wedges can be pulled up without movement of blades; (h) Blades are advanceable in direction of cut and can be set to precise tolerances.

The Style KF is made in four cutting diameters: 6, 8, 10, and 12 in., either right- or left-hand.

Kennametal Inc., Latrobe, Pa.

Viking Surface Grinder For Precision Work on Small Parts

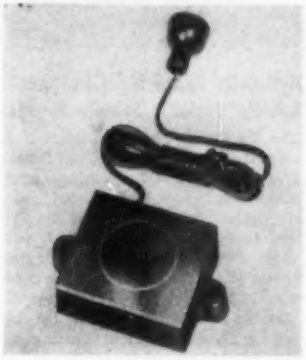
This bench-type precision surface grinder features an extra heavy headstock, micrometer adjusting dials, precision spindle with heavy-duty ball bearings for fast precision work on small parts.

Included as standard equipment is an unusually small magnetic chuck. Machine is powered by a 1/3 hp continuous-duty dual-voltage motor, and is designed for mounting a 4-in.-dia wheel. Wheels of ½ x ½ x 4-in. are recommended. A No. 7 Brown & Sharpe Taper is standard equipment, which also permits setting up the machine for slitting

saws, screw-slotting cutters, etc.

An adjustable pilot light is mounted on the base of the machine. Size of the base is 11 x 18 in. Table working surface is 9½ x 6 in. A unit with switch for demagnetizing can also be provided. The table is mounted on a rugged dove-tail way, and is quickly and easily traversed by hand lever. Micrometer dials for vertical and cross feed adjustments are graduated in 0.001 in. permitting fine settings. Because the machine is simple to operate, small light workpieces requiring good finishes, precision limits, can be ground quickly, accurately and economically with little physical effort.

Viking Industries, 220 Montague St., Rockford, Ill.



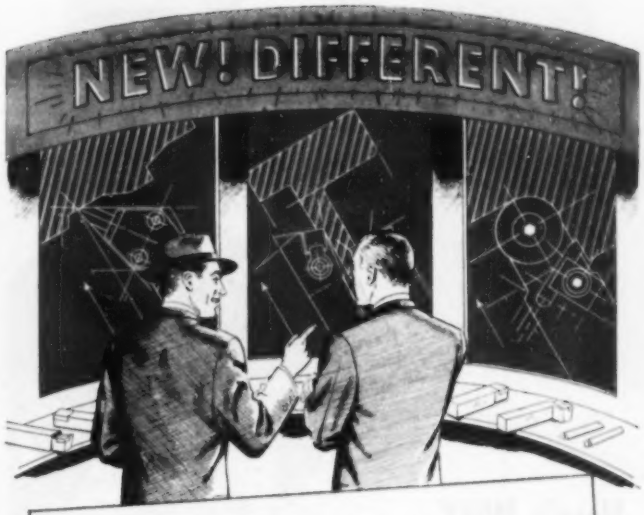
Small-Sized Magnetic Chucks Have Deep Penetrating Power

Two small-sized magnetic chucks that concentrate deep magnetic holding power in a small, compact area are now available to speed precision grinding of small work pieces.

The units have small, rectangular steel surface plates, precision ground parallel with the mounting base. The base is two opposed flanges drilled and countersunk for Allen-head screws which simplifies setups. The chucks are designed for safe operation, will not arc across, and are cool operating which permits holding close tolerances on a production basis.

Both units, which are the smallest built for the purpose, operate equally well in either horizontal, angular or vertical plane. Because they are small in size, setup and resurfacing time is greatly reduced. Operation is from a 6-volt, dc current rectified from standard ac. Complete units with rectifier can also be supplied.

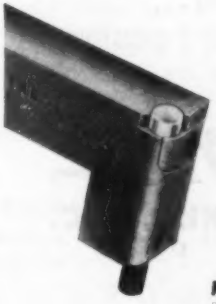
Model G4 shown in photo has surface plate 3⅝ in., overall height is



See How . . .
KENNAMETAL
TOOL ENGINEERING
Increases Productivity

KENNAMETAL EXHIBIT
SPACE 1723
ASTE EXPOSITION
CHICAGO AMPHITHEATRE
MARCH 17-21

At the ASTE show—Kennametal Inc. will demonstrate, with giant-size tool layouts, how to get improved use from your metal-cutting machines, as well as how to reduce tooling costs. Today these factors are of extreme importance as a means to help you offset the effect of inflation.



You'll see how good tools, in the hands of skilled operators, can increase productivity on a wide range of metal-cutting operations—trepanning, deep hole drilling, high production runs, heavy duty cutting, tracer jobs, carwheel boring, milling, etc. Don't miss it!

KENNAMETAL Inc.
Latrobe, Pa.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY

GARRISON
GEAR CHUCKS
CUT SCRAP LOSS!

Here's WHY

Built-in accuracy and exclusive, patented fixed multiple location, "average-out" errors of cutting and heat treating.

EVERY GARRISON GEAR CHUCK ALSO FEATURES:

QUICK CHUCKING . . . Garrison gear chucks have increased production as much as 700%.

QUICK SET-UPS . . . Garrison gear chucks are ready for use as soon as they are mounted to a simple face plate or adapter.

SHORT OVERHANG . . . Assures closer limits and better finish.

VERSATILITY . . . Garrison gear chucks are used for any operation after the teeth are cut.

Garrison pitch line control gear chucks are "custom-built" for each gear by specialists who have manufactured gear chucks exclusively for over thirty years. This accumulated gear chuck knowledge pays off for you at final inspection.

To cut scrap loss, eliminate upset schedules and assure consistent, uniform high production day after day . . .

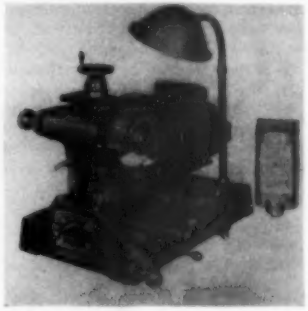
. . . SEND YOUR GEAR PRINTS FOR A QUOTATION!

Garrison

MACHINE WORKS, INC.
DAYTON 4, OHIO

15-16 in. Counterbored ¼ in. mounting holes are spaced on 4¼-in. centers. Model G4A, a more powerful unit, has one-third greater holding power than Model G4. Surface plate is 3¾ x 4¼ in. Overall height is 1½ in.

Viking Industries, 220 Montague St., Rockford, Ill.



Hydraulic Speed Mills Feature Infinite Variable Spindle Speeds

The basic machine construction of former Model No. 618 hydraulic speed mill, built by Viking Industries has been improved and strengthened by addition of the 2½-in.-round steel overarm which provides extra rigidity to the cutter arbor. The outboard end of the overarm is supported by a heavy adjustable saddle and steel bracket which assures efficient cutting action, close precision tolerances on extra heavy duty work without adding attachments.

Infinitely variable spindle speeds are a feature which, with automatic travel, substantially increases output capacity. Correct spindle and table speeds for jobs can be quickly and easily selected, reducing setup time and insuring longer cutter life. The table cycle incorporates infinite cutting feeds, rapid approach and quick return.

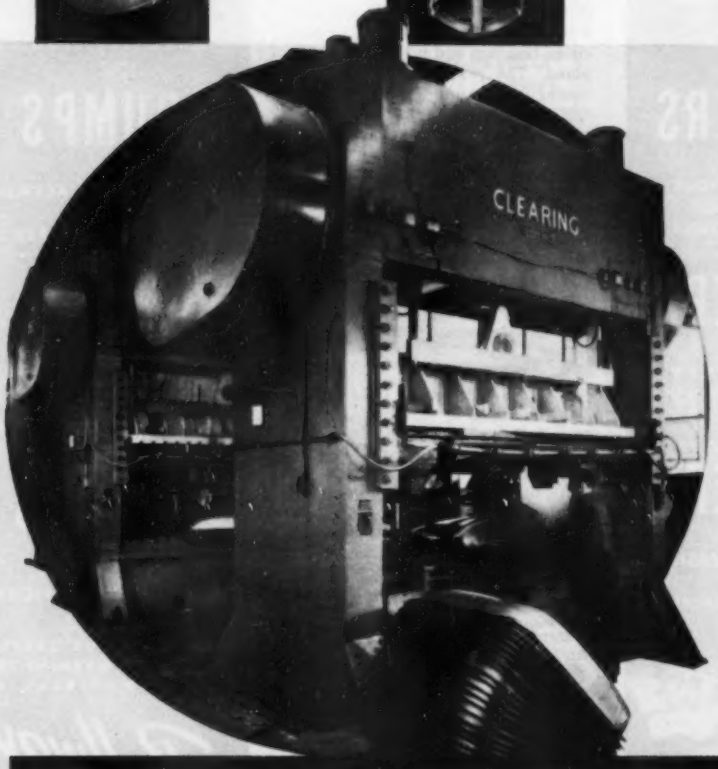
Two separate models are available, one designed with a duplex system that handles climb milling jobs, the other for conventional milling work. Both are cabinet units designed to occupy small floor space, 30 x 32 in. wide. Over-all height is approximately 52 in. They are powered by a ½-hp, 3-phase, 60-cycle, table-drive motor, and a ¾ hp, 3-phase, 60-cycle, spindle motor of 1800 series. The single-unit drive shaft operates with the coolant and hydraulic pumps.

Working surface for both machines is 7⅝ x 24½ in. Max. cutting length is 7 in. Traverse adjustment of the

From expensive casting to low cost stamping.

Heavy truck fabrication.

Truck fender.



NO GAME OF CHANCE...

Getting the best from presses is an operator's stock in trade in the contract stamping business. Competition is keen, and successful old timers, like Briskin Mfg. Co., Chicago, didn't get that way without a great deal of production skill.

Briskin put their money on Clearing presses because Clearings gave them the maximum quality, economy, on-schedule production and minimum waste that are the watchwords of Briskin production. Die regrinds are few and far between and maintenance costs are lower, too.

Where competition is tough and economical production means a winning hand, Clearing presses are dependable assets. Looking at results is a good way to choose *your* press equipment too! For production, your best choice is Clearing.

CLEARING MACHINE CORPORATION

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HAMILTON DIVISION, HAMILTON, OHIO

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THE WAY TO EFFICIENT MASS PRODUCTION

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TO DESIGN, REDESIGN, OR DEVELOP YOUR PRODUCT

ENGINEERS

TO TOOL AND EQUIP YOUR PLANT FOR THE BEST PRODUCTION ECONOMICS

ENGINEERS

TO GET YOUR NEW PRODUCTION GOING AND KEEP IT GOING

ENGINEERS

TO REDUCE YOUR COSTS AND IMPROVE YOUR QUALITY

ENGINEERS, DESIGNERS, CONSULTANTS AND PRODUCTION SPECIALISTS

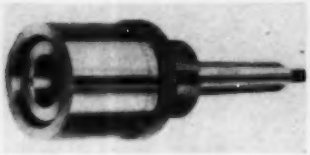
PIONEER ENGINEERING & MANUFACTURING CO., INC.

19651 JOHN R STREET
DETROIT 3, MICHIGAN

INQUIRIES PROMPTLY ANSWERED

table is 1¾ in., and vertical adjustment is 7½ in. The units accommodate milling cutters up to and including 6-in. dia. They are equipped with a 2-in. dia heat-treated and ground alloy-steel spindle with a 17/32 through-hole and a No. 9 Brown & Sharpe taper. Spindle runs in precision bearings and is in a stationary plane. The work is adjusted by raising or lowering the table. Simple dial controls make it quick and easy to select the proper speeds and feeds and obtain maximum cutting efficiencies.

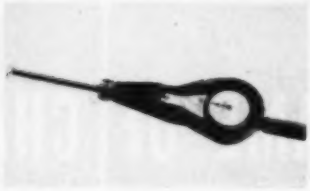
Viking Industries, 230 Montague St., Rockford, Ill.



Stop-Collar and Stop-Nut Holder

With this unit, the depth of cut may be regulated by stopping the adjustable collar or nut against the jig or workpiece being machined. It is available in a range of sizes for use on work requiring specified depth of cut.

Metal Cutting Tools, Inc., Rockford, Ill.



Indicating Gage Measures Bores Between ¼- and ⅛-In. Dia

Increased scope of the Standard Gage Co. dial bore gage line is now available with the addition of No. 00 Model suited to bores between ¼ in. and ⅜ in. This model will check tolerances up to 0.005 in. with an accuracy of 0.0001 in.

The gage employs centering-size discs a few thousandths smaller than the bore to be gaged. The discs attached to the head of the instrument are locked firmly in place by means of a knurled clamping nut. Discs can be readily interchanged for different-sized holes in the range from ¼ to ⅜ in. The gage is believed by the manufacturer to be the

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PUMPS

POSITIVE DISPLACEMENT AND IMPELLER TYPES

PUMPS

J. I. C. STANDARDS OR DIRECT MOTOR CONNECTED

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DEPENDABLE, ECONOMICAL, EFFICIENT

STANDARD OR SPECIAL, FOR EVERY MACHINE TOOL AND INDUSTRIAL USE

Rollway PUMPS

Pioneer PUMP & MANUFACTURING CO., INC.

19651 JOHN R STREET
DETROIT 3, MICHIGAN

WRITE FOR CATALOG

• *A typical Nicholson file tooth shape in greatly exaggerated size. Mottled area is a photomicrographed cross section of file after hardening. The uniformly distributed white iron carbides are of extreme hardness.*

A good tip to remember

In a file, it's the tip of the tooth that counts. That's the part which does the work. On it depend the file's cutting efficiency and serviceable life. Nicholson metallurgy, tooth designing, cutting machinery, hardening processes—all combine to put onto Nicholson and Black Diamond file teeth the strongest, sharpest, longest-lasting tips science and human skill can achieve.

That's why the tips of the teeth give you the tops in file performance (plus the tops in value) when you buy Nicholson or Black Diamond brands. Your industrial distributor will back up that statement.

• • •

READ MORE ABOUT FILE QUALITY, kinds, use and care in Nicholson's famous 48-page illustrated book, **"FILE FILOSOPHY."** It's ***FREE.*** Send for your copy.

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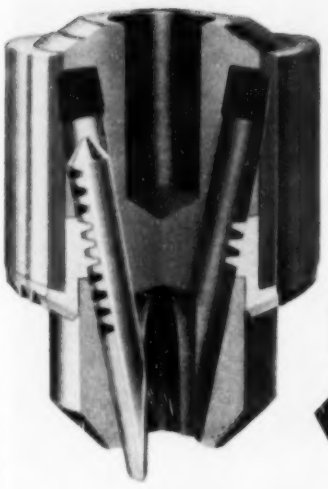
NICHOLSON . . . A FILE FOR EVERY PURPOSE

HERE ARE REASONS WHY IT PAYS TO BUY

SUPREME BRAND CHUCKS


Entire chuck body is hardened inside and out.
Outer shell is smooth . . . an added safety feature.
Supreme brand chucks and keys are interchangeable with other makes.
Threaded nut and key driven gear are one piece.
Jaws are nickle chrome moly alloy steel, expertly heat treated and precision ground.
Each chuck individually tested for accuracy.

SUPREME

Here are facts about the outstanding quality and precision manufacturing of the SUPREME Brand Chuck . . . that make it rugged . . . that make it stand up on the job. Job test it on your own work and you'll experience performance that is most convincing as to its long lasting quality . . . accuracy and dependability.

Check the above features, then prove them to yourself by ordering a supply from your distributor. If you do not find him handling the SUPREME line . . . write direct.

SUPREME BRAND CHUCKS

Supreme Products, Inc., 2222 South Calumet Avenue, Chicago, Illinois

THE CHUCK THAT LIVES UP TO ITS NAME . . . SUPREME

simplest and most convenient in this respect in the whole field.

The plunger which actuates the indicator is sapphire tipped and the centering-size disk is chromium plated to assure long wear-life. The dial indicator incorporated in the instrument is hooded to protect it from accidental knocks.

Standard Gage Co., Inc., Poughkeepsie, N. Y.

Magnetic-Base Lighting Unit

Portable magnetic-base lighting unit instantly holds up to 100-watt standard incandescent bulb to curved or flat surfaces. Flexible ball-and-socket bracket construction permits absolute illumination of work wherever needed. It has an aluminum socket. A rayon-flocked light shield resists heat and protects user's eyes.

Base size is 1 x 1⅝ x 4 in. Magnetic pull is 100 lb. A fingertip lever releases magnet for removal or repositioning. Six feet of 18-2 oil resistant cord comes with each set.

ENCO Mfg. Co., 4525 W. Fullerton Ave., Chicago 39, Ill.

Demagnetizing Unit from England Removes All Residual Magnetism

The Eclipse Demagnitizer from England, weighing just 7 lb, is said to offer better performance than many

other demagnetizers several times its size. It is compact and portable and with a low power consumption can be plugged into any lighting socket or power plug of suitable voltage and frequency.

It will give a maximum demagnetizing effect with a minimum of heating and as an additional safety precaution, a buzzer gives a warning signal to prevent the apparatus being left on inadvertently. The unit will remove all residual magnetism and workpieces can be quickly and efficiently demagnetized by simply passing them across the gaps between the platens.

On fast production where it is considered necessary to demagnetize large pieces by a single pass across the platen and a standard model is thought to be too small, multiple units can be supplied built on one mounting board and operated by a single control switch.

The demagnetizers are all worked from a single phase ac supply 200/250 volts, 40/60 cycles, 100/130 volts 40/60 cycles and 100/130 volts 20/30 cycles. Standard types can be adapted to other voltages and frequencies.

Factory representatives:

Lane & Curran, 440 Whitehall St., New York 4, N. Y.

Multiple Nut Runners Positioned to Suit Work

Multiple nut runners mounting standard or altered nut runners in clusters, positioned and spaced to suit the work to be done are now available from Ingersoll-Rand. The time savings obtained are in direct proportion to the number of nuts or cap screws to be run. The correctly spaced and mounted individual nut runners are connected to a common

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OLD TIME VALUES
IN
MODERN HANDLING EQUIPMENT
You've got to
Buy CLARK

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MOTOR—Designed for **CLARK** for the specific power requirements of industrial use. Fuses protect both motor and circuits against damage.

★

STEERING AXLE—Pivoted—all four wheels **always** on the ground: better traction, better steering, utmost stability.

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DRIVE AXLE BY CLARK—Regular Hiway-Truck-Type Clark axle—the best that can be said of any axle.

★

AUTOMATIC ACCELERATION as employed on **CLARK** Electrics takes out the human error—**no jerking**—

★

DIRECTIONAL LEVER on **STEERING COLUMN**—greatly simplifies operation, increases maneuvering speed and fast getaway.

★

BRAKES—HYDRAULIC—Smooth, positive action for safe operation—ruggedly built for long-lived efficiency.

To meet the varying needs of users, CLARK electric fork-truck motors are designed to operate efficiently on any power supply from 30 to 48 volts. CLARK'S standard power supply is 36 volts. These trucks are designed with perfect balance among all components and incorporate a new method of motor winding which provides more efficiency than has ever been offered in an industrial truck motor . . . There have been many technical changes from year to year in CLARK machines, but there has never been any change in CLARK'S 30-year purpose to give you the best VALUE your money can buy—and there never will be.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS
AND POWERED HAND TRUCKS · INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIVISION • CLARK EQUIPMENT COMPANY • BATTLE CREEK 3, MICHIGAN
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NATIONWIDE CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

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INTERNATIONAL AMPHITHEATRE
CHICAGO, MARCH 17-21

- Discuss your fastener problems.
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- See the complete Mac-it line, plus many specials, sold through leading industrial distributors.
- You'll find a real welcome whether you're one of Mac-it's old friends or are "just looking".

Marketed Nationally Since 1913 by
STRONG, CARLISLE & HAMMOND CO.
Cleveland 13, Ohio
Manufactured by MAC-IT PARTS COMPANY, Lancaster, Pennsylvania

Severance CHATTERLESS TOOLS HIGH SPEED CARBIDE

Winning their way on job after job, they are carefully designed to precede chatter and can be depended on to produce superior finishes.

Severance CHATTERLESS COUNTERSINKS

STANDARD TYPE — Stocked in 12 diameters up to 2" and in 30°, 41°, 45°, and 60° angles (with C/L).

Sizes 1" and larger stocked also threaded for shanks — tapered or straight — in various sizes.

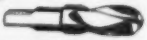
Use CARBIDE for tough jobs or high production.

HEAVY DUTY TYPE — Features larger shanks having a tang drive. Full range of sizes and angles.

Severance CHATTERLESS BALL SEAT REAMERS

Standard and Heavy Duty Types
8 sizes each.
Made also for shaped cavities — as ordered.

BALL HOSE DRILLS — In corresponding sizes hog out the stock for Ball Seat Reamers.



Severance TAPER REAMERS

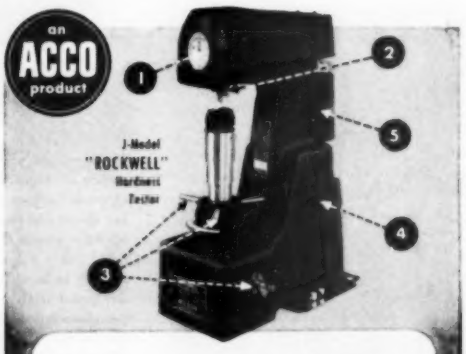
- Faster cutting
- Better finishing
- Clean-cut teeth

Tapers up to 15° quickly supplied from stock — up to 1½" diameter x 2⅝" long.

Unexcelled for holes having keyways, ports, splines, cross holes, etc.

Write for Catalog 18
SEVERANCE TOOL INDUSTRIES, INC.
726 IOWA AVE. SAGINAW, MICH.
In Canada: 60 Front St., W. Toronto

an ACCO product



5 Important "ROCKWELL"* Features

1. Totally enclosed, dirt and dust-proof "Zerominder" dial gauge. 2. Gripsel clamp screw for quick change and proper setting of penetrator. 3. All controls grouped conveniently. 4. Enclosed, easy-to-reach, variable speed dash pot. 5. Standardized weights. These features assure accuracy and ease of operation.

There are two models of WILSON "ROCKWELL" Hardness Testers, plus the TUKON for micro-indentation hardness testing. Write for information.

ACCO *Trade Mark Registered
WILSON MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE
230 Park Avenue, New York 17, N. Y.

WILSON "ROCKWELL" and TUKON Hardness Testers

manifold mounted on the machine, and the unit is provided with a common set of handles. As multiple nut runners are used with spring balancers, the weight of the combined tools is no objection.

As the tools are all supplied with air from a common backhead, and the air pressure is adjusted so the tools stall at the required torque, all nuts are run to precisely the same degree of tightness. As the torque uniformity obtained is accurate, subsequent torque checking operations can be eliminated. The tools are all mounted on a common fixture, so their individual torques cancel out each other, thus making the multiple nut runner an extremely easy-to-use tool. The units are all built to fit the customer's jobs.

Ingersoll-Rand Co., 11 Broadway, New York.

Tool Grinder for Carbides Forms Complicated Radii

This machine is especially designed and built for carbide tools, and has two diamond wheels; one for roughing, and the other for finishing. The wheelhead swivels to bring either one into position over the toolholder.

Tools are held in a ball-and-socket vise that has good rigidity. The vise and inclinable table allow grinding single-point tools to constant clearance angles, regardless of radii or dips in profile. Mounted on ball bearings, the rotary worktable

OUT OUR WAY
CAN'T TH' FATHEADS TELL HE'S JUST PICKING UP A PAIR OF CALIPERS OR SUMPN'F WHY IF HE WAS CAUGHT IN TH' MACHINE, IT WOULDN'T PULL HIM OVER, CUZ IT TURNS THIS WAY.
WELL, MAYBE THEY THINK HE WENT THRU UNDER IT ONCE -- BUT THEY OUGHT TO REMEMBER SOL-SPEEDI-DRI HAS STOPPED SLIPPIN' ACCIDENTS HERE!
THE MINUTE MEN
J.R. WILLIAMS
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To lead its field, a product must give best value for the money, all factors considered. That's exactly what you get with Sol-Speedi-Dri—and that's why more firms buy Sol-Speedi-Dri than any other oil and grease absorbent. Send coupon today for free sample and literature about how to keep your floors clean and slip-proof by "dry cleaning" with Sol-Speedi-Dri.
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FREE SAMPLE: Fill out the coupon and mail today for free sample and literature.
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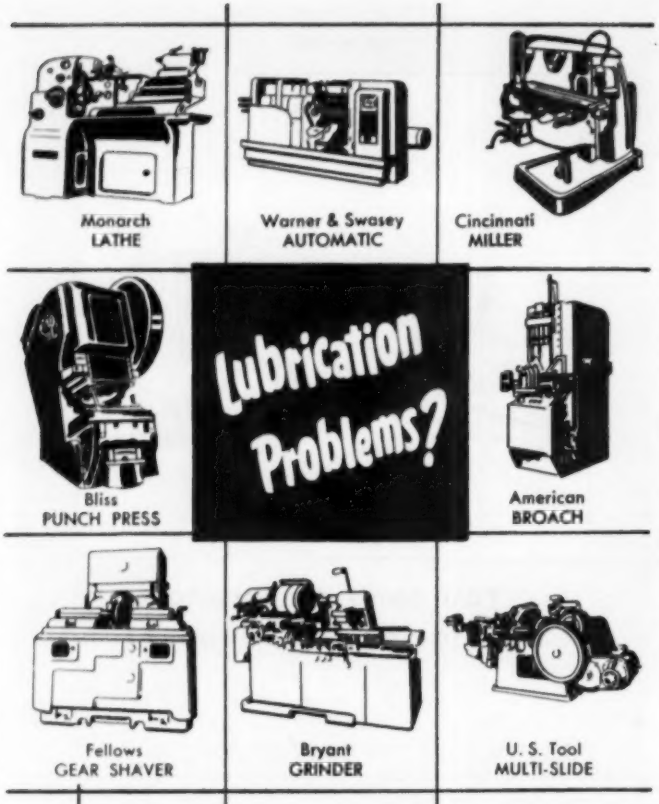


not on these machines!

...they're all BIJUR equipped

Every one of these machines is designed for continuous production. This is made possible by the built-in Bijur lubricating system. It oils the machine during operation and reduces bearing wear by controlling oil feed *at the bearings*. In both cases, it converts down-time for maintenance into more time for production. When you buy a Bijur-lubricated machine, you're assured of built-in bearing protection.

Write for Bulletin MW

BIJUR

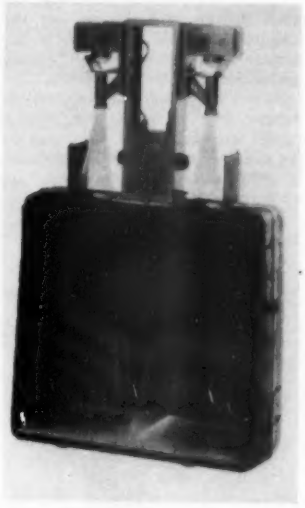
LUBRICATING CORPORATION

Rochelle Park • New Jersey

swivels to produce concave, convex, and intersecting radii.

Lubricant is applied to the wheels centrifugally through holes in the middle of the wheels. The liquid is carried in an overhead tank. Imported from France by:

H E B Machine Tools, Inc., 341 Madison Ave., New York 17, N. Y.



Portable Unit Used for Surface Comparison Examinations

The Faxfilm surface comparator consists of a portable comparison projection unit with a removable work case. Thirty diameter magnification is provided by Wollensack 1-in. focus F/1.9 projection lenses. The images appear side by side on a screen at the base of the case and may be viewed from either or both sides by raising the hinged doors which make up the bottom halves of the sides of the case. The specially designed slide holder in each projector permits positioning of the replicas during projection so any part of one image may be made to appear immediately beside any part of the other image. Long-strip replicas of large areas may be used in the projectors also. Rheostats equalize light intensity for accurate comparisons. Both projectors are removable. Higher magnification may be obtained by removing a projector or by turning either projector horizontally to project on a wall or screen, one diameter of magnification being obtained for each inch of projection distance.

The unit provides a flat projective

MUELLER BRASS CO.

"600" SERIES

a better bearing bronze containing no-hard-to-get tin

If you use gears, connecting rods or other parts requiring bearing properties, it will pay you to investigate "600" Series, a high strength bronze that *contains no tin*. "600" Series outperforms phosphor bronzes and other bearing metals . . . it will also save time, money, and material. "600" Series bearing metals can be forged into relatively complicated shapes and produce a forging of close-grained homogeneous structure impossible to get in a sand casting. The forged shape is closer to finished size than a casting, often requires less machining, and eliminates the need of a bushing. "600" Series is available in standard and special extruded shapes in 12' mill lengths. These alloys have a low coefficient of friction, a tensile strength 2½ times greater than cast phosphor bronzes and high resistance to corrosion. There is a "600" Series alloy with the properties to fit your bearing metal need...write today for further facts.

Typical forged parts and ROD shapes produced from Mueller Brass Co. "600" Series bearing bronze

MUELLER BRASS CO.

PORT HURON 18, MICHIGAN

most any product in most any industry can be made better with

DOWICIDE "A"

Dowicide® A is water soluble and is, therefore, easily added to water extended adhesive solutions giving them protection from decomposition caused by mold and bacterial attacks.

Dowicide A is used to disinfect buildings, egg storage rooms, and poultry feeding stations. When used in the wax emulsion coating, it protects citrus fruits from blue mold and stem-end rot.

Dowicide A protects soluble oil emulsions from bacterial decomposition and the accompanying unpleasant odors, emulsion breakdown, and the clogging of screens.

Water solutions of Dowicide A are used as disinfectants and germicides in public buildings and homes, and as a deodorant in and around garbage cans and chemical toilets.

Dowicide A is used effectively to disinfect contaminated walls before the application of a mold resistant paint. Water extensible paints are preserved with Dowicide A.

In the paper industry, Dowicide A is used to protect paper sizing and coating solutions from mold and bacterial attack, both during use and storage.

Rayon or silk thread in storage is protected against mildew by the addition of Dowicide A. It is also used to preserve protein, animal glue, casein and starch sizing solutions.

Dowicide A prevents mold and bacterial growth during many stages of leather processing. It is also used to protect coating and finishing materials from costly bacterial attacks.

MAKE your own tests today! We believe you will find even more new uses for Dowicide A. If you are confronted with a specific problem, make use of Dow's complete laboratory facilities—write for information concerning the many different Dowicide products, including Dow's PENTA, the dependable wood preservative.

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Dowicide Department DC-103, Midland, Michigan
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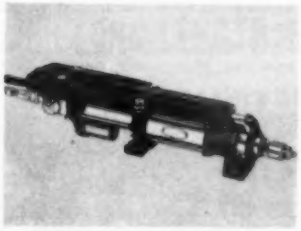
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

of curved or irregular shapes without damaging the test pieces. The process is valuable in determining the machining characteristics of a material and in establishing the proper machining operations for production of a new part. It may be used to record changes in surface conditions of specimens during wear tests and to compare these conditions at the conclusion of the test. While the Faxfilm is permanent, it also may be used much as a negative to provide photographs of the test surfaces.

The removable work case is a convenient unit for use with the comparison projection unit, or for use on trips as a complete single projection unit. When the case is open the masonite working surface 8x10 in. is available with ribbon and solvent in conveniently located receptacles. The work case is 11½x 10x4 in. and weighs only 5 lb without the projector, or 7 lb with the projector. Both cases are of leather-grained, maroon Royalite over a steel and aluminum frame. The unit uses ac or dc 110 to 120 volts, and 200-watt lamps. Combined weight is 28 lb. Dimensions of comparison unit, closed, are 25x 12 at the base and 22½ in. high.

The Brush Development Co., 3405 Perkins Ave., Cleveland 14, Ohio.



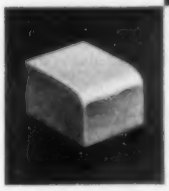
Built-In Control On An Air-Power Drilling Device

A drilling device named the Hydrair is electrically controlled, but air powered with the feed rate hydraulically controlled. Drilling capacity is ¼ in. with maximum depth of stroke 4 in. The Hydrair features rapid advance, controlled feeding through the work and rapid return. All controls are built in.

Standard spindle rated free speed is 2800 rpm. Rated horsepower ¼, developing a maximum of approximately 1/3 hp. at 1500 rpm. Five additional optional speed ranges are available to make the unit adaptable to widely varying materials. Optional speed ranges available are

From deburring tubing . . .

to sanding bevels



Armour Backstand Belts do the job right

For the thousands of jobs where backstand belts can save you time, for the thousands of jobs other coated abrasives do so well, Armour has the answer—there's an Armour coated abrasive to do *your* job right.

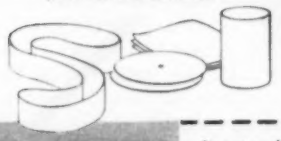
Saves 3 out of 5 minutes!

The LeRoi Company in Cleveland, Ohio, switched from set-up wheels to backstand belts in finishing forged paving breaker handles. Finishing time was reduced from 5 minutes 11 seconds to 1 minute 32 seconds—*saving 3 minutes 39 seconds per handle!* Now they know, too, that Armour's coated abrasives cut faster, last longer, and give a better finish.

Belts are only one of the many forms of coated abrasives available to you from Armour. There are more than 30,000 different varieties in grit size, backing, etc. Sheets, rolls, discs, tubes—and specialty sizes to meet your specifications.

Let your industrial supply distributor tell you about this complete Armour line. And ask him for your free copy of the booklet, "Facts about Backstand Belt Grinding and Polishing"—or send the coupon today.

We recommend buying through your industrial distributor



ARMOUR *Coated Abrasives*

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Please send me the free booklet, "Facts about Backstand Belt Grinding and Polishing."

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Title .....

Firm .....

Address .....

City ..... *Zone* ..... *State* .....

COMPLETE TO THE WOR "GO"!

Hanson-Whitney makes all types of mechanical thread gauges to meet every critical test regardless of thread form, pitch or major diameter.

INSURE YOUR PRODUCT ACCURACY!

SPEED INSPECTION PROCESSES!

TURN TO ONE RELIABLE SOURCE — HANSON-WHITNEY.

A. G. D. GO AND NO GO ADJUSTABLE THREAD RING GAGES & HOLDER

A. G. D. TRUNCATED SETTING PLUG AND DOUBLE END WORK PLUG

VISUAL THREAD GAGE COMPARATORS STANDARD AND DUAL MODELS

ANPT and NPTF (Dryseal) Pipe Thread Gage

SEE OUR COMPLETE GAGE DISPLAY AT THE ASTE SHOW.

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Place: International Amphitheatre, Chicago, Illinois

Booth No. 829 "Quality Control Hall"

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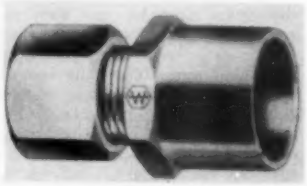
THREAD MILLING AND
THREAD GRINDING MACHINES

QUALITY CONTROLLED FROM *Start to Finish*

17,000 rpm, 5000 rpm, 14500 rpm, 850 rpm, and 500 rpm. Spindle travel is powered by a Bellows Air Motor with the built-in electrically-controlled Electroaire valve. Control of the feeding rate is taken over at any desired point in the spindle travel by a Hydro-Check giving a fully adjustable hydraulic feed-rate control. Feed rate is adjustable from 0 in. per min. up to 200 in. per min. at 90-lb air.

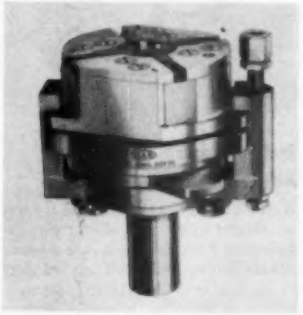
Bellows Co., 230-236 West Market St., Akron 9, Ohio



Weatherhead Reducing Tube Requires No Flaring, Threading, or Soldering

Consisting of a body, nut, and sleeve, with one end machined in the form of a tube and a regular Ermeto connection on the opposite end, this reducer works equally well on high or low pressures. It will handle reductions ranging from 2 to ⅛ in. It is available in steel, stainless steel, and brass.

The Weatherhead Company, Industrial Div., Cleveland 8, Ohio



Self-Opening Die Head For B&S Automatic Screw Machines

This aligning self-opening die head is for Brown & Sharpe automatic screw machines, and any other machines where the die head does not rotate such as turret lathes, hand-screw machines, etc. The die head is provided with an alignment fea-

LONG-LENGTH BUSHINGS ARE STANDARD AT UNIVERSAL— No waiting for production

All long-length bushings listed as standard in the Universal Catalog are regular stock items which means speedier delivery to you. If you have been experiencing difficulty in securing long-length bushings, it will pay you to investigate Universal's service. The *super finish I.D.* of Universal Standard Drill Bushings lengthens bushing life . . . reduces tool breakage . . . slashes drill wear.

With the added features of blended radius, knurled head, I.D. break and chamfered O.D., you'll get better bushing service and need less replacements. To further speed delivery order from the warehouse nearest you—1060 Broad St., Newark, N. J., 5035 Sixth Ave., Kenosha, Wisc., or the home office.

OTHER UNIVERSAL PRODUCTION TOOLS

Thousands of Parts Are Heat Treated Daily in 'Surface' Hardening Furnaces

Successful heat treatment means control of costs, economy in operation, conservation of labor and materials

★ During the past 10 years people making adding machines, milling machines, tanks, trucks, dies, gears, typewriter parts and many other items have steadily increased their reliance on 'Surface' Standard Rated Hardening furnaces.

Selection of a furnace for hardening operations depends on production rate required, contour and dimensions of the part, temperature required, and desired final surface condition.

Cutter wheel liquid heated at 1550°F for 20 mins. in 'Surface' Standard Rated Pot Furnace.

▲*Electric Refrigerator shaft steel hardened in 'Surface' Standard Rated Small Oven Furnace*

To meet these needs, 3 general types of hardening furnaces are available, each in many models and sizes: *Oven Type:* direct-fired; standard hearth areas are 1.5 to 45 sq. ft. Larger sizes are available, if required. For hardening where volume production and flexibility to handle large pieces are important. Send for Literature Group HO.

Pot Type: used where charge must be protected from air or decrementally heated. These furnaces are used for heating salt, oil or lead for interrupted quench baths. 24 standard sizes. Circular or rectangular. Send for Literature Group HP.

Prepared Atmosphere Type: for complete surface protection and where dimensional stability is required. Muffle type, externally fired. Send for Literature Group HA.

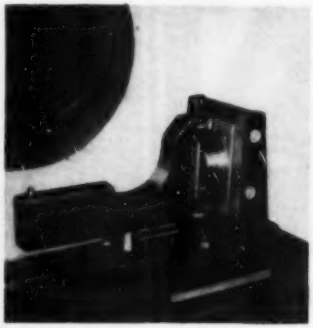
SURFACE COMBUSTION CORPORATION
TOLEDO 1, OHIO

(ADVERTISEMENT)

ture to take care of misalignment of turret and spindle. The heads are made available for such situations where correct alignment of turret hole and spindle is an essential factor in accurate screw-thread cutting.

The heads have the following advantages: (1) front-end trip for accurate tripping on even the shortest threads; (2) pull-off trip for safety; (3) bunting spring to allow desirable fast camming; (4) pull-off spring; (5) uses low-cost insert chasers. The die head is available in four sizes in capacities from $\frac{3}{8}$ dia. and 1 7/32 long up to 1 in. dia., $\frac{7}{8}$ in. long.

The Eastern Machine Screw Corp., New Haven 6, Conn.



Fluidmotion Dresser Forms Compound Angles

This under-wheel equipment can be adapted to cylindrical, internal, and tool and cutter grinders. It will form two angles tangent to a radius in one continuous motion with an accuracy to 0.0001 in. without use of dovetails.

The dressers are made of high-chrome alloy steels; hardened, ground, and lapped to resist abrasion. Dustproof stainless bearings swivel the dressers.

Accuracy on a 14-in. wheel is to a tenth, and on a 36-in. wheel to five tenths. Angle dressing is done by pushing the control handle in either direction. After the radius is formed, this will blend the angles with the curve. The diamond returns to center when the handle is released.

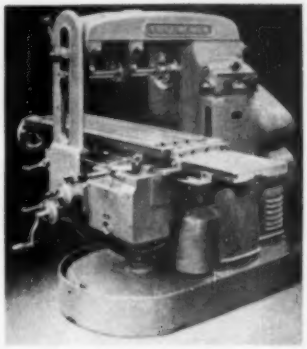
J & S Tool Co., E. Orange, N. J.

•

Thread inserts have been made available in the following standard sizes and thread classifications: 4-40 to 1½-6 sizes, in the National and Unified

(New Equipment at the Tool Show continued on p. 265.)

now available



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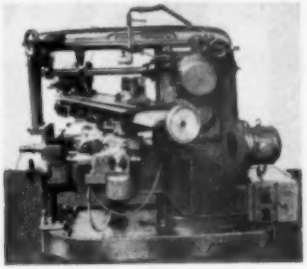

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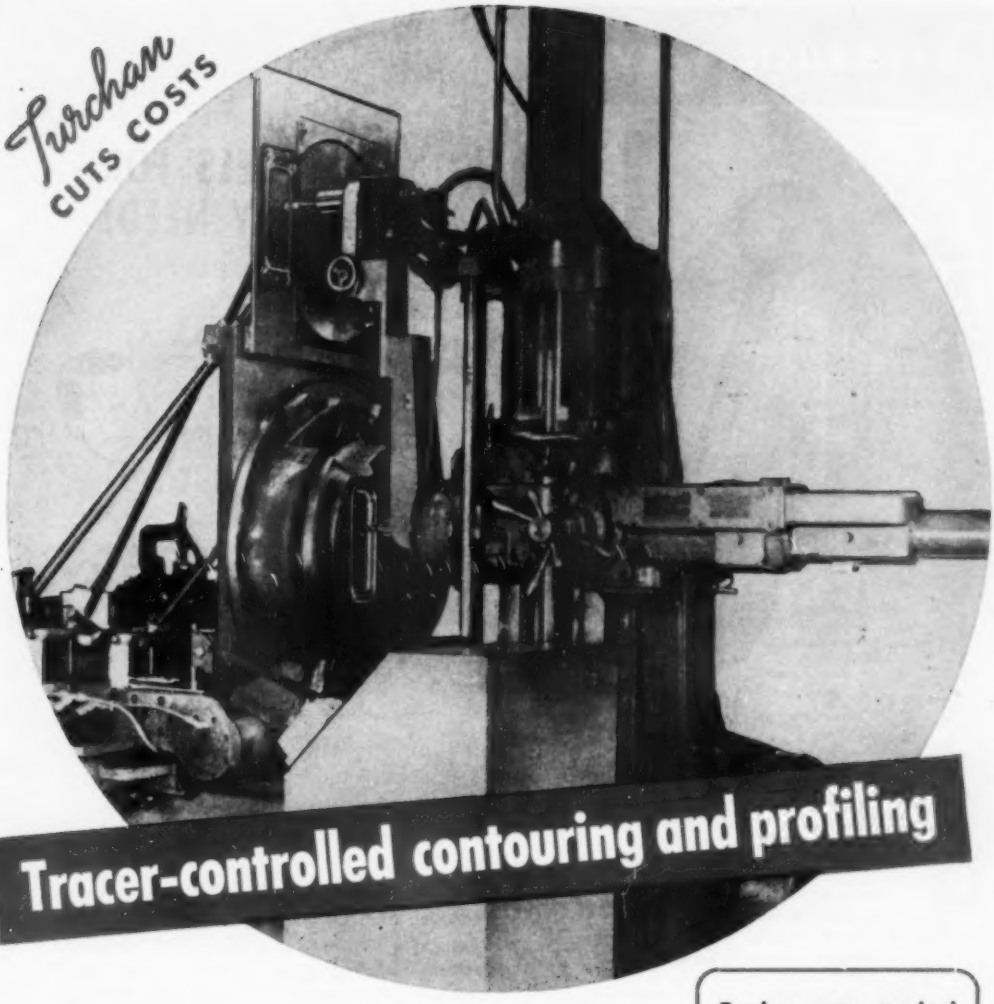
UNIVERSAL, VERTICAL & PLAIN
MILLING MACHINES

Manufactured by one of the largest machine tool manufacturers in Europe, these millers offer every feature you could desire for economical, perfect precision operation—plus *reasonable* delivery. In sizes 1, 2, 3, 4 and 5, universal, vertical and plain—also manufacturing types. Write today for complete illustrated brochure No. 6.

MARAC MACHINERY CORPORATION
1819 Broadway • New York 23, N. Y.
Circle 7-2048

Turchan CUTS COSTS



Tracer-controlled contouring and profiling

Tank turret openings are rapidly machined by Turchan Follower Attachment, without the necessity of specially built equipment or skilled help, to accuracies well within the required limits. In this application the tracer handles 360° control with hydraulic drives attached to the vertical and cross feeds. Once the depth of cut is determined and work started the tracer follows the template and automatically controls movement of the cutting tool, requiring attention only when the tool reaches a corner. Any type of standard horizontal boring mill can be similarly equipped. There are also Turchan followers for vertical mills, planers, shapers, lathes, grinders. "Turn to Turchan to cut costs." Tell us your problems.

Turchan puts standard boring mill on automatic basis to produce wider range of work, faster and better for armament requirements.

WRITE TODAY: Send a sketch and specifications of any job. Give make of machine. We'll show you how to produce it better, faster, at lower cost.

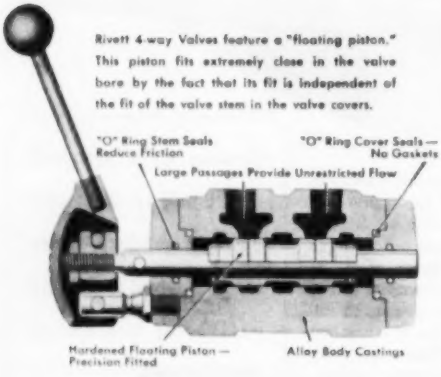
Turchan FOLLOWER MACHINE COMPANY

Oldest Manufacturer of Hydraulic Duplicating Attachments for Machine Tools

HYDRAULIC VALVES–

138 MODELS FOR EVERY NEED!

offered in 1500 P.S.I.—3000 P.S.I. for most models
Five piston designs to meet the requirements of any circuit
Six types of operation —hand, foot, cam, solenoid, oil pressure, air pressure
Four types of action —standard, spring return, spring centered, ball detent
Seven sizes available —¼", ⅜", ½", ¾", 1", 1¼", 1½"


Rivett 4-way Valves feature a "floating piston." This piston fits extremely close in the valve bore by the fact that its fit is independent of the fit of the valve stem in the valve covers.
"O" Ring Stem Seals Reduce Friction
"O" Ring Cover Seals — No Gaskets
Large Passages Provide Unrestricted Flow
Hardened Floating Piston — Precision Fitted
Alloy Body Castings

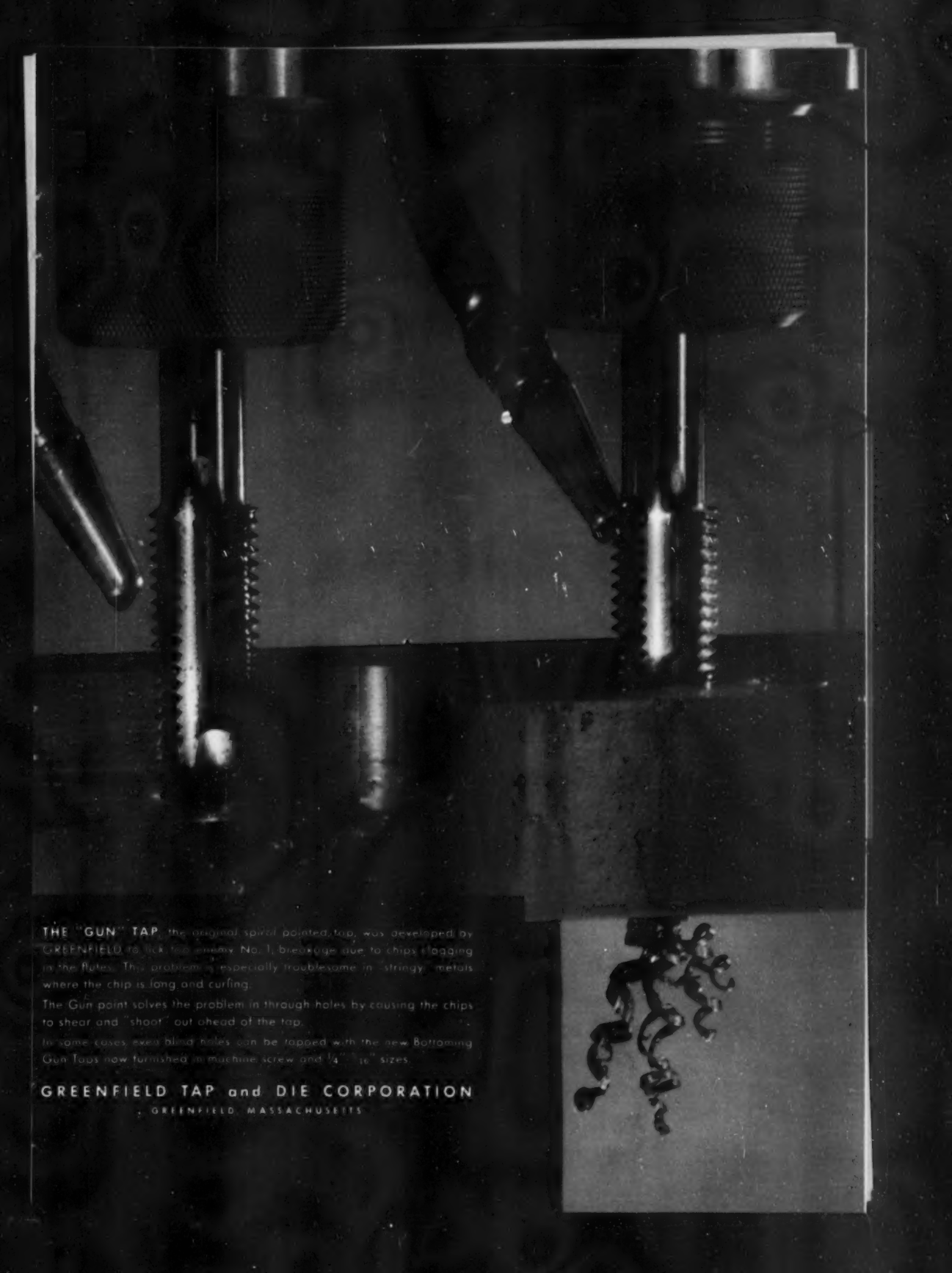
You can plan a more efficient hydraulic circuit by choosing from the wide selection of Rivett valves. Every type of control is available, both direct and remote, including sequence, shut-off, check, relief, unloading, flow control and pilot. Not only does this Rivett variety assure you of a better operating system, but it also offers far greater latitude in design.

With Rivett you get the help of experienced distributors, who will assist in laying out the circuit best suited to your operating requirements.

RIVETT LATHE & GRINDER, Inc.
DEPT. AM 3A BRIGHTON 35, BOSTON, MASSACHUSETTS

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS
Air and Hydraulic
All sizes and types



THE "GUN" TAP, the original spiral pointed tap, was developed by GREENFIELD to lick tap enemy No. 1, breakage due to chips clogging in the flutes. This problem is especially troublesome in "stringy" metals where the chip is long and curling.

The Gun point solves the problem in through holes by causing the chips to shear and "shoot" out ahead of the tap.

In some cases even blind holes can be tapped with the new Bottoming Gun Taps now furnished in machine screw and 1/4" - 16" sizes.

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

GEO MET RIC

DS and DD CLEVELAND

convertible self-opening die head

with aligning shank

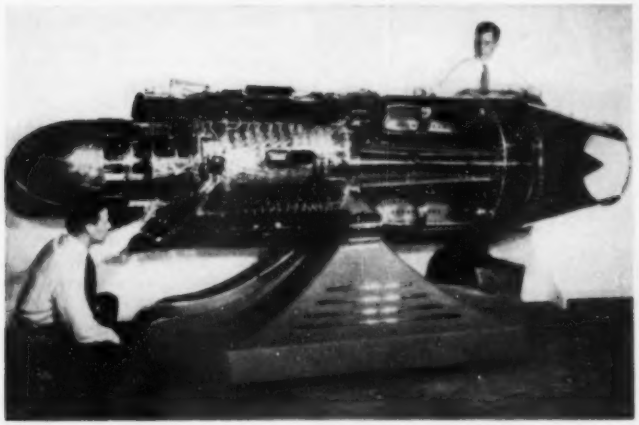
Style DS

SPECIFICATIONS

Style and Size Letter	MACHINE USED ON	CAPACITY Ext. Threads Dia.	CAPACITY Ext. Threads Length	CAPACITY Ext. Threads Coarse-est Pitch	Std. Pipe	Code Word	A	B	C	D	E	F	G	H	J	K	Standard Shanks† Dia.	Standard Shanks† Lgt.	Max. Shanks without Bushings Bore	Max. Shanks without Bushings Dia.	Max. Shanks without Bushings Lgt.
ALIGNING SHANKS																					
DS ⅜	00 and 000-B. & S. Auto. 0-B. & S. Wire Feed & Hand	⅛ to 5/16	1½	18	None	Benak	1½	1 7/16	½	1 1/32	⅝	1 9/16	1 9/16	Max. 1 9/16 Min. ⅝	Max. ⅜ Min. 0	10–32 N.F.	⅝	1 5/16	1½	⅝	1 5/16
	Cleveland S.S.					Benet											⅛	6	Solid	°	
						Benol											⅛	6	Solid	1 1/16	6
						Benox											1 1/16	6	Solid		
DS ½	0 & 00-B. & S. Auto. 1-B. & S. Wire Feed & Hand	¼ to 5/16	1½	12	⅛ to ¼	Dexel	2 7/16	2 9/16	⅝	⅝	¾	1 9/16	1 9/16	Max. 5/16 Min. 1/16	Max. ⅛ Min. 0	12–28 N.F.	⅛	2 1/16	½	⅛	2 1/16
	Hand					Dexing											1	7	Solid	1	2 1/16
	Cleveland S.S.					Dexol											1 1/16	7	Solid	°	
						Dexon											1 1/16	7	Solid	1 1/16	7
DS ⅝	2 & 2G-B. & S. Auto. 2-B. & S. Wire Feed & Hand	⅜ to ½	2 1/16	10	⅛ to ½	Dexso	2 1/16	2 5/16	1 1/16	1 9/16	⅝	1 13/16	2 1/16	Max. ⅜ Min. ⅛	Max. 1/16 Min. 0	¼–28 N.F.	1	2 1/16	1 1/16	1	2 1/16
	Cleveland S.S.					Decap											1 1/16	7	Solid	°	
						Dexer											1½	7	Solid	1 1/16	7
DS 1	2G & 2-B. & S. Auto.* 2-B. & S. Wire Feed & Hand	⅜ to 1	2 1/16	10	⅛ to ½	Dexet	3 1/16	3 1/16	1 1/16	1 1/16	1 1/16	2	2 1/16	Max. 5/16 Min. ½	Max. 1/16 Min. 0	¼–28 N.F.	1	2 1/16	1 1/16	1 1/16	3 1/16
	4-B. & S. Auto. 4-B. & S. Wire Feed & Hand					Dexev											1 1/16	3 1/16	1 1/16		
NON-ALIGNING SHANKS																					
DS 1¼	2 & 2G-B. & S. Auto. 2-B. & S. Wire Feed & Hand	13/16–1 1/16	1 1/16	14	None	Dexev	2 7/16	2 11/16	1½	1 9/16	⅝	1 1/16	2 1/16	Max. 1/16 Min. ½	Max. 1/16 Min. 0	12–28 N.F.	1	2 1/16	None	1½	2 1/16
DS 1¾	4-B. & S. Auto. 4-B. & S. Wire Feed & Hand	1 1/16–1 5/16	2	14	None	Dexyo	3 1/16	2½	2 1/16	1 13/16	⅝	2 1/16	2 5/16	Max. 1/16 Min. ½	Max. 1/16 Min. 0	¼–28 N.F.	2	3 1/16	1 5/16	2	3 1/16

NOTE: Standard D Chasers used in 5/16" and ½" sizes. C Type Chasers used in larger sizes.
*Die Head modified with clearance to swing on machine. (Length that can be cut when shank is solid.
*Minimum Shank Diameter without shoulder is ¼" on 5/16" DS, 7/16" on 5/16" DS and 1 1/16" on ¾" DS. †Special Shanks furnished at extra cost.

GEOMETRIC TOOL COMPANY DIVISION
Greenfield Tap and Die Corporation
NEW HAVEN 15, CONNECTICUT



Arthur Nichols (right), co-owner, W. H. Nichols Co., Waltham, Mass., typical small supplier company to GE's jet-engine program, holds lube-oil pumps made for the J-47 turbojet aircraft engine (shown at left)

17,000 Subcontractors Split GE Defense Dollar

WASHINGTON—Of the more than $600 million General Electric Company holds in defense contracts, more than half will go to subcontractors for farmed-out work.

In this election year, GE is trying to impress on Congress and the public that contracts to big business do not mean a close-down of small business.

A recent count showed that GE is depending on more than 17,000 subcontractors to help carry out its defense contracts. These include the production of such diversified equipment as jet engines and aircraft instruments, radar and turbosuperchargers, gunfire-control systems for aircraft and ships, guided missiles and torpedos.

A sampling of these 17,000 concerns indicate that 80% of them employ 500 persons or less, and are thus classified as small business. In turn, these suppliers do business with tens of thousands of other small concerns.

GE's supply base extends throughout the country, from small shops employing 25 or 30 persons, producing one small item, to large organizations, a major share of whose overall activity is technical in nature.

In setting up its Lockland (Ohio) plant for production of the J-47 jet engine, GE sketched out the role to be played by subcontractors:

(1) Components of the engines, with which few companies had any manufacturing experiences, to be built by over 200 subcontractors.

(2) Developing multiple sources of supply for each item.

(3) GE, as prime contractor, doesn't make any of the components for its Lockland-built engines. In other words, the Lockland plant was to be an assembly and test center whose engine parts, made to GE engineering designs, flowed from subcontractors all over the country.

How does this kind of plant stack up against one in which the prime contractor does most of the manufacturing? GE answers that it does very well. At its Lynn, Mass., plant GE does more of the manufacturing. It is able to beat prices of its subcontractors to a small extent, but there is no discernible difference in the quality of the product produced.

A big plant like GE has to line up its suppliers years in advance of need. The Lockland subcontractors were being lined up in 1948. But it still keeps the way open to take on new subcontractors after production gets underway.

Right now, GE headquarters in Schenectady, N. Y., is receiving bids from subcontractors on all sorts of items. Or if a small manufacturer has facilities, the large concern often can advise what particular needed device can be manufactured.

GE Subcontractor Cites Role Of Small Business in Defense

WASHINGTON — Selected from 17,000 GE defense subcontractors and suppliers to represent small business at the GE conference here, Howard Roessler, owner, Roessler Machine Co., Inc., Germantown, Pa., spoke on the "Case History of a Small Company and its Role in Defense Business."

Mr. Roessler described his company's activities prior to World War II rebuilding racing-boat motors and its entrance into the subcontracting field in 1940 for the Heintz Mfg. Co., Philadelphia. In 1948 the company obtained its first direct contract from GE for jet-engine parts machined from high temperature stainless-steel alloys. He spoke of the help given by General Electric in securing materials and equipment and how at the present, the company is subcontracting work of its own.

"A small business with a little know-how and a willingness to give service can and does receive from large business, the necessary cooperation that it must have in order that it itself may grow and prosper," Mr. Roessler concluded.

NON-STOP
from tool room to press
VIA
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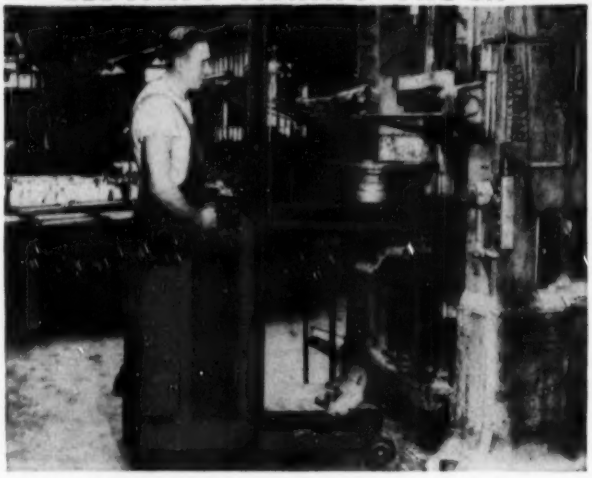
ELECTRIC TIERING TRUCK



- Now, load up the die in the tool room . . . go non-stop (up to 3½ mph) through narrow aisles and crowded production areas . . . and position it right at the machine with this RAYMOND Platform-Type Electric Tiering Truck! There'll be no wasted work-time, no halt in production because one man can do the whole job alone.
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RAYMOND
ELECTRIC INDUSTRIAL TRUCKS
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subcontracting NEWS

Convair Sets Up Guided Missile Division as Functional Unit

SAN DIEGO, Calif.—Consolidated Vultee Aircraft Co. has created a single Guided Missile Division to take charge of this type of work in all its plants, including the new one under construction at Pomona, Calif.

Headquarters for the new division headed by Gage Irving, who has supervised the Pomona operations, will be in San Diego "for the moment", Convair executives said.

The division will handle engineering and electronic research and production and its personnel will no longer divide its time between both guided missile and more conventional aircraft work. Convair's other divisions—at Fort Worth and San Diego—are geographical. "This division will be functional and may include personnel and equipment anywhere," the firm explained.

Sikorsky Delivers First Cargo Helicopter To Army

WASHINGTON — The first cargo helicopter manufactured for the Army has been delivered at Fort Bragg, North Carolina, by Sikorsky Aircraft Div., United Aircraft Corp., Bridgeport, Conn. The craft is the first of 97 ordered for delivery during 1952.

Designated the H-19, it is a single-rotor helicopter with a capacity of 10 passengers or eight litters plus crew (pilot and co-pilot), or a ton of cargo plus crew.

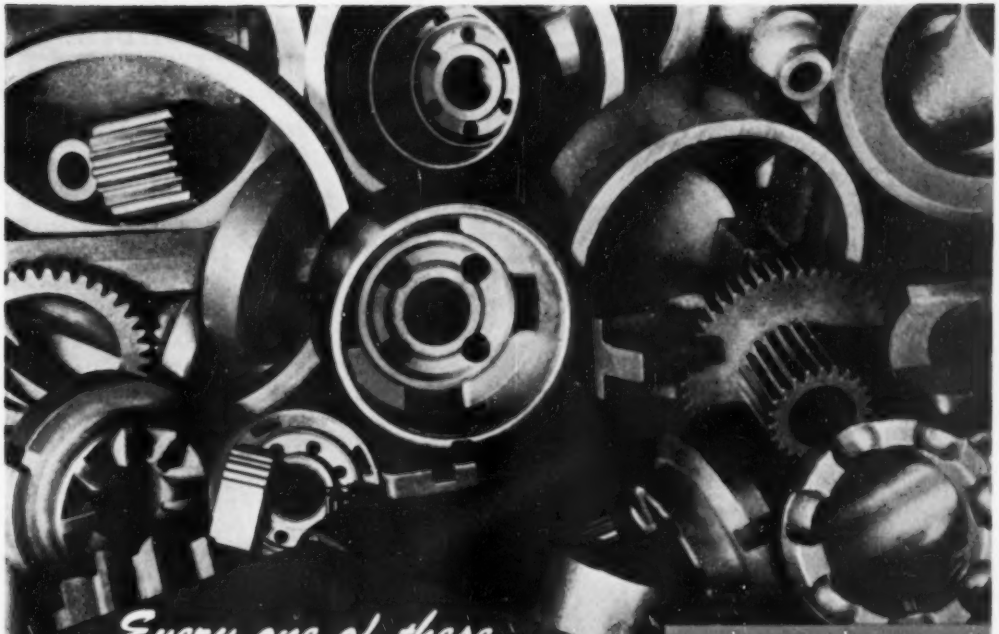
The H-19 is intended primarily to speed the supply of food, ammunition, medical items and related goods to front lines and to transport troops to otherwise inaccessible areas.

Boeing Awards Subcontract For B-47 Modifications

SEATTLE, Wash. — Boeing Airplane Co. has awarded a subcontract to the Grand Central Aircraft Co., of Glendale, Calif. and Tucson, Ariz., for a B-47 modification program at Tucson.

The Arizona facility will be utilized for special changes to completed B-47 medium bombers.

John J. Clark, a former assistant factory manager in the Boeing Wichita division, will be Boeing's principal representative in the new modification program.



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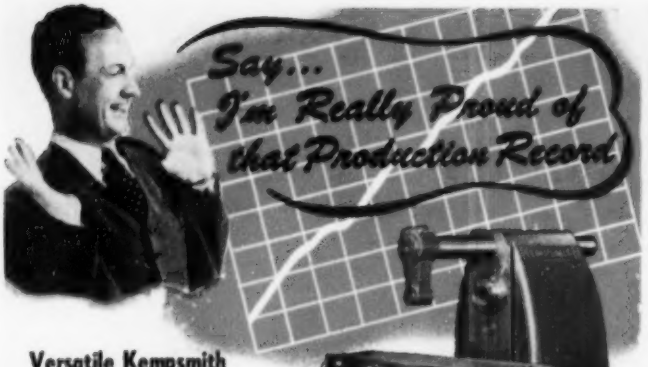

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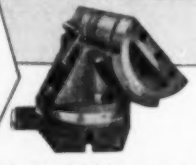

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subcontracting NEWS

New Company Gets $3.5 Million Douglas Subcontract

OAKLAND, Calif. — Western Sky Industries, a new corporation, has been awarded a Douglas Aircraft Co. subcontract for more than $3.5 million worth of aircraft components. The company, located here, was to start tooling work by the end of February on the contract, which is for wing sections for the AD-4 and AD-5 Sky Raider, Navy attack bomber. Incorporated late in December with a capitalization of $500,000, the company expects to employ 400 workers on a $1.2 million a yr payroll.

Nearly all of the officers of the new corporation presently hold management level jobs in the aircraft industry. Ray T. Elsmore, president, is senior vice president for Transocean Air Lines; Elon Brown, vice president, is president of Taylor Industries; Robert E. Hilliard, treasurer, is treasurer of Aircraft Engineering & Maintenance Co., Transocean subsidiary, and S. McKee Mhoon, secretary, is assistant to the president at Transocean.

Bid Contract Awards to Small Firms

WASHINGTON — By ruling of the Comptroller General, advertised bid contracts may be awarded to small business even at above low bid, "when such action is in the public interest" or when the Small Defense Plants Administration and the contracting agency jointly determine that it is "in the interests of mobilizing full productive capacity, or in the interest of the national defense program".

Opportunity may be given unsuccessful bidders in the small business class to match the low bid, making it possible to split up contracts at no additional cost to the Government.

New Jet-Engine Test Plant

WASHINGTON — Construction will start this month on a $50-million plant to be built by the Navy at Romulus, Mich., for testing jet-engine assemblies.

Scheduled for completion in the spring of 1953, the plant will consist of a ½-million sq ft main building, 18 engine-test cells and a test building, on a 160-acre site. The plant will be operated in conjunction with a J-40 engine fabrication and sub-assembly plant at Wayne, Mich.

40% of Thunderjet Airframe Built by Republic Subcontractors

FARMINGDALE, L. I., N. Y.—Republic Aviation Corp. at the end of 1951 was using about 300 subcontracting installations for parts manufacture of the F-84 Thunderjet. Subcontractors were producing about 40% of the airframe, an increase of 10% over December, 1950.

In addition to jet-part makers, Republic is using more than 1900 companies as suppliers of raw materials, equipment and non-production items. The supply network extends throughout the country with most of the burden being carried by neighboring Long Island companies.

Subcontracting officials at Republic estimate that production operations during 1952 will climb to 67% of the F-84G airframe. The principle function of the Farmingdale factory will be that of an assembly plant, although the company will continue to carry on pilot production projects.

Two out of every three dollars spent by Republic for subcontracting services go to companies in the small business classification.

Northrop Anaheim Plant Backlog Hits $25 Million for Fire Controls

HAWTHORNE, Calif. — Defense orders totaling about $25 million are now scheduled for production at the Anaheim Division of Northrop Aircraft, Inc., Oliver P. Echols, chairman of the board and general manager, announced recently.

Negotiations will begin soon on nearly $16 million in additional contracts, General Echols added.

Col. W. S. Broberg, chief of the Los Angeles District, U. S. Army Ordnance Corps, disclosed that two types of fire-control devices are to be produced by the Anaheim plant for the Ordnance Corps. One is already in production and a new type is slated to go into manufacture soon.

Twin-Jet Fighter Contract

ST. LOUIS, Mo. — The McDonnell Aircraft Corp., has been awarded a contract for production engineering and tooling for production of a twin-jet fighter airplane. Dollar value of the contract was not disclosed. The plane is designed to escort bombers, attack distant targets and provide close support for ground troops.

LATEST DEFENSE CONTRACTS

ARMY ORDNANCE AWARDS

Tank-Automotives Center, Detroit

Armstrong Rubber Co., West Haven, Conn.—hardware replenishment, $118,848.

H. B. Egan Mfg. Co., Muskogee, Okla.—replenishment, tires and tubes, exceeds $250,000.

GMC Truck & Coach Div., GMC, Pontiac, Mich.—motor vehicle parts, exceeds $250,000 on each of two contracts.

United Motors Service Div., GMC, Detroit—hardware replenishment, $147,738.

National Farm Machinery Co-op. Inc., Shelbyville, Ind.—replenishment of tools, $122,593.

Circo Div. Topper Equip. Co., Matawan N.J.—tool replenishment, $139,306.

McCord Corp., Detroit—motor vehicle parts, exceeds $250,000.

Detroit Ordnance District

Sarnac Machine Co., Benton Harbor, Mich.—20-mm, powered linker, $225,074.

Vickers, Inc., Detroit—motor pump assemblies and parts, $186,051.

Ternstedt Div., GMC, Detroit—range finder and spare parts, exceeds $250,000 on each of two contracts.

Fisher Body Div., GMC, Detroit—facilities for production of tank, 90-mm gun, M48, and concurrent spare parts, exceeds $250,000.

Philadelphia Ordnance District

Mack Mfg. Corp., Washington—truck chassis 5-ton, exceeds $250,000.

Standard Steel Works, Burnham, Pa.—breech-ring forgings, 105-mm howitzers, exceeds $250,000.

Lehigh Foundries, Inc., Easton, Pa.—facilities, $152,550. HE shells, 60-mm, exceeds $250,000.

Bowen & McLaughlin, York, Pa.—tank rebuilding, exceeds $250,000 on two contracts.

Baldwin-Lima-Hamilton Corp., Philadelphia—welded hulls, M-47 tanks, exceeds $250,000. Facilities, exceeds $250,000.

Pittsburgh Ordnance District

Robertshaw-Thermostat Div., Robertshaw-Fulton Controls Co., Youngwood, Pa.—booster, cotterpin and ring assembly and detonator cup, exceeds $250,000.

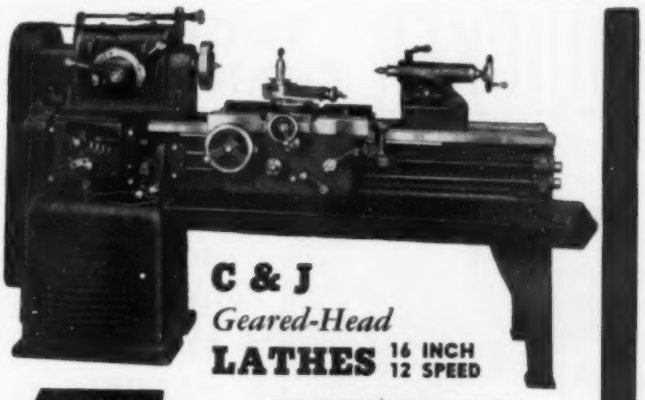
Los Angeles Ordnance District

Bowen & McLaughlin, Phoenix, Ariz.—spare parts, Ford-engine, exceeds $250,000.

Watervliet Arsenal, N.Y.

Midvale Co., Philadelphia—rectifiers for gun-tube chrome-plating equipment, exceeds $250,000. Breech rings, $212,520.

(Continued on page 256)



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ARMY ORDNANCE AWARDS . . . continued

New York Ordnance District

S. W. Farber, Inc., New York, N.Y.—facilities, exceeds $250,000.

United Can Co. Inc., New Village, N.J. — ammo containers, exceeds $250,000.

Golwynne Chemicals Corp., New York — atomized magnesium, exceeds $250,000.

Birmingham Ordnance District

Enterprise Aluminum Co., Massillon, O.—supplementary charge for deep-cavity shells, figure not available.

Ribbonwriter Corp., Dania, Fla.—fin shells for 60-mm mortar assembly, figure not available.

Auto Solar Co., Atlanta, Ga.—sight unit with equipment, figure not available.

St. Louis Ordnance District

Cameron Iron Works, Houston, Tex. — breech-ring forgings, figure not available.

Monroe City Diecasting, Monroe City, Mo. —loading plug accessories, figure not available.

Rupert Diecasting, Kansas City, Mo.—loading plugs, figure not available.

Rochester Ordnance District

Cleveland Container Co., Ogdensburg, N.Y. —75-mm ammo containers, exceeds $250,000.

Easy Washing Machine Corp., Syracuse—fuses, non-delay and delay, exceeds $250,000.

SIGNAL CORPS AWARDS

Philadelphia Supply Agency

A.B.F. Products, Inc., River Forest, Ill.—signal generators, $234,592.

Belmont Radio Corp., Chicago—receiver transmitter, exceeds $250,000.

Burgess Battery Co., Freeport, Ill.—batteries $106,680, and exceeds $250,000 on each of two contracts. Dry batteries, $106,106.

Cook Electric Co., Chicago — switchboard signal, $216,474.

Emerson Radio & Phonograph Corp., New York—radio sets, exceeds $250,000.

General Electric Co., Philadelphia—motors, $156,200.

General Insulated Wire Works, Providence, R.I.—wire reels, exceeds $250,000.

Hallicrafters Co., Chicago—radio sets, exceeds $250,000 on each of two contracts.

Mechanical Handling Systems, Detroit—floor-type conveyor, $111,055.

Raytheon Mfg. Co., Waltham, Mass.—radio set, exceeds $250,000.

Sperry Gyroscope Co., Great Neck, L.I., N.Y.—electron tubes, $247,904.

Burgess Battery Co., Freeport, Ill.—batteries, $106,680, $136,245 and exceeds $250,000 on two other contracts. Dry batteries, $106,106.

Lewyt Corp., New York — receiver-transmitters, exceeds $250,000.

Lionel Corp., New York—receiver, telephone, $110,267.

Magnavox Co., Fort Wayne, Ind.—receiver-transmitters, exceeds $250,000.

P. R. Mallory & Co., Inc., North Tarrytown, N.Y.—dry batteries, exceeds $250,000.

Marathon Battery Co., Wausau, Wis.—batteries, $246,000.

Micro-Lite Co., Inc., New York—flashlights, $106,400.

Miller Equipment Co., Venango County, Pa. —linesman's equipment, $123,969.

Munston Mfg. & Service, Inc., I-lip, L.I., N.Y.—test equipment, exceeds $250,000.

Parkchester Machine Corp., New York—mountings, exceeds $250,000.

Pilot Radio Corp., Long Island City, N.Y. —power supply, exceeds $250,000.

Presto Recordings Corp., Hackensack, N.J. —maintenance parts, sound-locating set, exceeds $250,000.

Rauland-Borg Corp., Chicago—power supplies, exceeds $250,000 on each of two contracts.

Roller-Smith Corp., Bethlehem, Pa.—electrical indicating instruments, $115,150.

Siltronic Co., Pittsburgh—control boxes, exceeds $250,000.

A. F. Smuckler & Co., Inc., Brooklyn, N.Y. —test sets, $297,716.

Sparks-Withington Co., Jackson, Mich.—frequency meters, exceeds $250,000.

Specialty Assembly & Packing, Brooklyn, N.Y.—tool equipment, exceeds $250,000.

Times Facsimile Corp., New York—ac motors, facsimile equipment, $140,250.

ARMY ENGINEER AWARDS

Philadelphia District Engineer

Cummins Engine Co. Inc., Columbus, Ind.—spare parts, $182,676.

United States Motor Corp., Oshkosh, Wis. —generator sets, exceeds $250,000.

International Fremont Machinery Co., Ramapo, N.Y.—generator sets, exceeds $250,000.

Taylor-Wharton Iron & Steel Co., Cincinnati—nitrogen cylinders, exceeds $250,000.

Industrial Air Products Co., Portland, Oregon—gas cylinders, $197,835.

Linde Air Products Co. Div. Union Carbide & Carbon Corp., New York—gas cylinders, exceeds $250,000.

Stuart F. Louchheim Co., Philadelphia—circulating fans, $124,260.

Peerless Pump Div., Food Machinery and Chemical Corp., New York—centrifugal pumps, exceeds $250,000.

Sterling Engine Co., Buffalo, N.Y.—generator sets, exceeds $250,000.

Kohler Co., Kohler, Wis.—generator sets, exceeds $250,000.

D. W. Onan & Sons, Inc., Minneapolis — generator sets, exceeds $250,000.

Electric Service Engineering Co., Joliet, Ill. —load test stand, exceeds $250,000.

The Buda Co., Harvey, Ill.—generator sets, electric, exceeds $250,000.

Harrisburg Steel Corp., Harrisburg, Pa.—gas cylinders, oxygen, exceeds $250,000.

Taylor-Wharton Iron & Steel Co., Cincinnati —gas cylinders, oxygen, exceeds $250,000.

Refrigeration Engineering Corp., New York —air-conditioning units, trailer-mounted, exceeds $250,000.

Southern Oxygen Co., Bladensburg, Md.—welding equipment, oxyacetylene, $121,065.

Pittsburgh District Engineer

J. S. Thorn & Co., Philadelphia—aluminum bulk, $112,394 and $120,182.

Dunham-Wilson Co. Inc., Baton Rouge, La. —sway braces, exceeds $250,000.

International Steel Co., Evansville, Ind.—Bailey-bridge panels, exceeds $250,000.

Steelcraft Mfg. Co., Rossmoyne, Ohio—Bailey-bridge panels, exceeds $250,000.

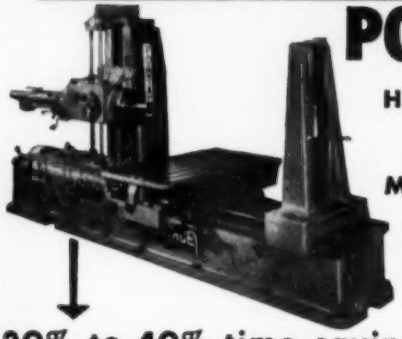
Cero Steel Products Corp., Chicago—Bailey-bridge panels, exceeds $250,000.

Commercial Shearing & Stamping Co., Youngstown, Ohio—Bailey-bridge panels, exceeds $250,000.

Michael Flynn Mfg. Co., Philadelphia—Bailey-bridge transoms, exceeds $250,000.

(Continued on page 258)

QUICKER TOOL CHANGE with PORTAGE



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Better — Continuous research has made Firth Sterling newest grades the standard of industry.

Faster — Increased production with Firth Sterling standards, available from warehouse and distributor stock.

Cheaper — Reduce operating costs and inventory with Firth Sterling standards.

R-997

Write for these quick reference cards today

R-192 —Standard Tips and Blanks

SA-1013—Standard Brazed and Mechanically Held Tools

R-194 —Standard Wire, Bar and Tube Drawing Dies

SA-1012—Standard Mining Tools

SA-1021—Standard Diecarb Perforators and Bushings

For information on the adaptation of Firth Sterling Standards to special applications, use the *New* FIRTHITE HANDBOOK—a complete tooling reference.

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subcontracting NEWS

ARMY ENGINEER AWARDS . . . continued

Modern Welding Co. Inc., Owensboro, Ky. —stringer button, exceeds $250,000.

Pittsburgh-Des Moines Steel Co., Pittsburgh —ramp buttons, exceeds $250,000.

J. S. Thorn Co., Philadelphia—rib and guard rails, exceeds $250,000. Frame bracing $112,-245.

Birmingham Fabricating Co., Birmingham, Ala.—transom clamps, exceeds $250,000.

NAVY AWARDS

Navy Purchasing Office, Washington 25, D.C.

Hughes-Keenan Corp., Delaware, Ohio —crane trucks, gasoline, $219,256.

Stewart-Glapat Corp., Zanesville, Ohio —portable conveyors, $164,876.

Bureau of Ordnance, Washington 25, D.C.

Gary Steel Products Corp., Norfolk, Va.—spherical floats, exceeds $250,000.

Inland Equipment Co., Nashville, Tenn.—dummy nose plugs, exceeds $250,000.

Macon Arms Div., Houdaille-Hershey Corp., Detroit—plant facilities, exceeds $250,000.

Hoadreg Co., Deming, N.M.—plant equipment, $193,000.

Nesco, Inc., Granite City, Ill.—parachute flares, aircraft, exceeds $250,000.

Kearfott Co., Little Falls, N.J.—plant equipment, $140,279. Fire-control transmitting and computing components, $102,747.

Arma Corp., Brooklyn, N.Y.—synchro-differential transmitters, transformers and receivers, exceeds $250,000. Components of fire control system, exceeds $250,000.

American Machine and Foundry Co., New York—plant equipment, $119,242.

Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn.—plant equipment, exceeds $250,000.

Westinghouse Electric Corp., Sharon, Pa.—plant equipment, exceeds $250,000.

Bureau of Ships, Washington 25, D.C.

National Electrical Machine Shops, Silver Springs, Md.—radio transmitter switchboards, cable and harness assemblies, exceeds $250,000.

RCA Victor Div., Radio Corp. of America, Camden, N.J.—transducers, $103,007.

Yale & Towne Mfg. Co., Philadelphia—hoist, chain electric, exceeds $250,000.

Hubert Johnson Boat Mfg. Co., Inc., Bay Head, N.J.—picket boat, exceeds $250,000.

Hacker Boat Co., Mt. Clemens, Mich.—picket boat, exceeds $250,000.

Blanchard Boat Co., Inc., Seattle, Wash.—picket boat, exceeds $250,000.

Wheeler Boat Co., New York—picket boat, exceeds $250,000.

Fellow & Stewart, Inc., Wilmington, Calif. —picket boat, exceeds $250,000.

Vaughan Shipyards, Inc., Wickford, R.I.—picket boat, exceeds $250,000.

National Co., Malden, Mass.—radio receiving set, exceeds $250,000.

Massa Laboratories, Inc., Hingham, Mass.—transducers, Sonar, $100,000.

Federal Telephone & Radio Corp., Clifton, N.J.—radio receiving sets, exceeds $250,000.

Bogue Electric Mfg. Co., Paterson, N.J.—motor generator sets, $192,448.

Construction Battalion Center, Port Hueneme, Calif.

Hussman Refrigerator Co., St. Louis—refrigerators, $236,460.

Stran Steel Div., Great Lakes Steel Corp., Detroit—prefabricated steel buildings, $328,-427.

Steelcraft Mfg. Co., Rossmoyne, Ohio —metal buildings, $958,341.

Ships Parts Control Center, Mechanicsburg, Pa.

Draco Corp., Philadelphia—repair parts, centrifugal and rotary pumps, $164,849.

Yarnall-Waring Co., Philadelphia — water gages, $105,291.

Skinner Engine Co., Erie, Pa.—repair parts, steam engines, $102,906.

Electro-Motive Div., GMC, La Grange, Ill. —diesel-engine repair parts, $348,400.

Falk Corp., Milwaukee—repair parts, main and auxiliary reduction gears, $128,339.

Sperry Gyroscope Co. Div., Sperry Corp., Great Neck, L.I., N.Y.—repair parts, gyro compass, $141,847.

Cooper-Bessemer Corp., Mt. Vernon, Ohio—repair parts, diesel-engine, $151,897.

Westinghouse Electric Corp., Philadelphia—repair parts for electric motors, circuit breakers and armatures, $245,769.

NAVAL AVIATION AWARDS

Air Material Center, Philadelphia

Warner & Swasey Co., Cleveland—universal turret lathes, exceeds $250,000.

Thompson Grinder Co., Springfield, Ohio—surface grinders, exceeds $250,000.

MARINE CORPS AWARDS

Quartermaster General, USMC, Washington 25, D.C.

U. S. Thermo Control Co., Minneapolis—refrigerating units, $110,450.

Libby Welding Co. Inc., Kansas City, Mo.—generator sets and maintenance parts, exceeds $250,000. Welders, $114,604.

AIR FORCE AWARDS

Air Material Command, Wright-Patterson AF Base, Dayton

Consolidated Photo Engineering & Lithographic Equipment Co., Chicago—photographic kits, $158,250.

Binkley Mfg. Co., Warrenton, Mo.—workbenches, $122,300.

Allison Div., GMC, Indianapolis—spare parts, $250,000.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.—transmitters, $134,482.

Titeflex, Inc., Newark, N.J.—miscellaneous spares, exceeds $250,000.

Fairchild Engine Div., Fairchild Engine & Airplane Corp., Farmingdale, L.I.—power plants, exceeds $250,000.

Airesearch Mfg. Co., Div. Garrett Corp., Los Angeles—actuator parts, $110,494.

Bohn Aluminum & Brass Co., Detroit—forgings, exceeds $250,000.

Ozone Metal Products Corp., Ozone Park, L.I., N.Y.—cylinder assemblies and struts, $100,000.

U.S. Burke Machine Tool Co., Cincinnati—milling machines, $123,750.

Guardite Corp., Chicago—spin pit, $104,200.

H. Z. Rosenberg & Co., Buffalo, N.Y.—parts and equipment, $122,876.

Studebaker Corp., South Bend, Ind.—engines, exceeds $250,000.

Packard Motor Car Co., Detroit, Mich.—engines, exceeds $250,000.

National Machinery Co., Tiffin, Ohio—heavy drop presses, exceeds $250,000.

Heppenstall Co., Pittsburgh—die blocks, exceeds $250,000.

Allison Div. GMC, Indianapolis—engines, exceeds $250,000. Spare parts, exceeds $250,-000.

Steel Improvement & Forge Co., Cleveland—machinery and equipment, exceeds $250,000.

Ronan & Kunzel, Inc., Marshall, Mich.—oxygen tanks, $111,544.

Westinghouse Electric Corp., Dayton—generators, exceeds $250,000.

General Electric Co. Schenectady, N.Y.—indicators, exceeds $250,000.

Kollsman Instrument Corp., Elmhurst, N.Y. —indicators, exceeds $250,000.

Single block of granite, weighing 50,000 lb, is being used in the Toledo plant of the City Auto Stamping Co., for precise inspection of dimensions and tolerances. Reported to be the largest block of granite ever quarried, the 192x96x32-in. plate is installed on a 32-in. concrete foundation and rests on three rubber cushions placed between the foundation and stone itself. The surface was lapped to 0.002 in. over-all flatness and has 20 drilled holes 2 in. deep. Each hole is fitted with metal lugs to clamp objects under test

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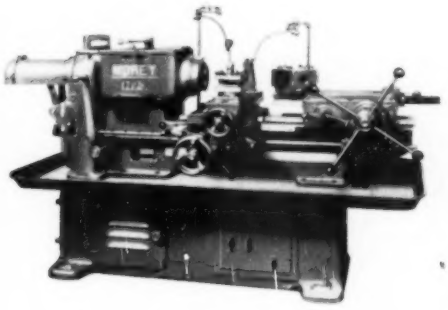
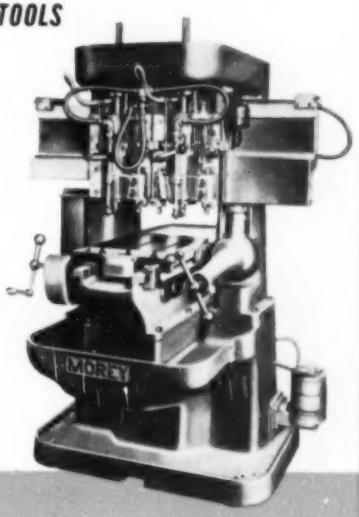
See us at the A.S.T.E. exposition at Chicago in March

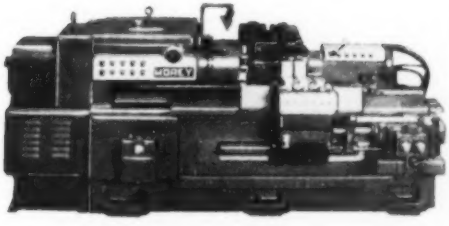
LET MOREY MEET YOUR REQUIREMENTS FOR THE FINEST IN MACHINE TOOLS



MOREY No. 3 UNIVERSAL TURRET LATHE, for ease and simplicity of operation. Rigid construction. Infinite number of spindle speeds within the range.



MOREY 12-M Double Spindle, High Speed VERTICAL PROFILER and Milling Machine . . . For rapid economical duplication of small parts requiring accurate interchangeability with minimum effort.



MOREY AUTOMATIC LATHE: As illustrated, tooled for the complete turning and facing operation of an automotive steering knuckle and other parts from the rough forging to finish size in one chucking.

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SELECTRONIC

MULTI-PURPOSE MACHINE:
HOMMEL

We are also general representatives for HAHN & KOLB, who have approximately 50 major machine tools and accessories.

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MILLING MACHINES ..... PAGE 3
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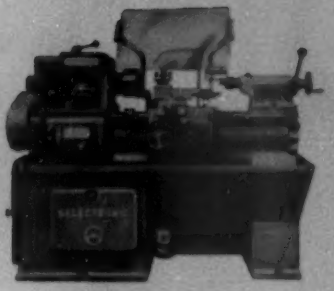
MOREY MACHINERY CO., INC. • 410 BROOME ST. • NEW YORK 13, N. Y.

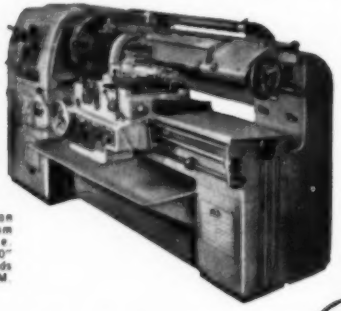
LATHES

Illustrated and briefly described here are just a few of the many fine lathes from these prominent European manufacturers. BONDYCOP Hydraulic Copying Attachments also available for all types of lathes.



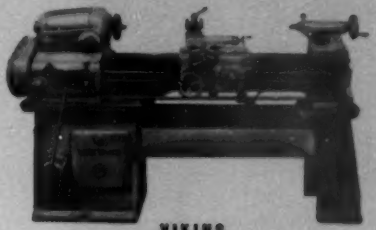
SELECTRONIC

13" x 22¼" centers. Production lathe. Pre-selector speed control. Spindle speeds (variable): 125-1600 RPM. Motor drive . . . Can be supplied with Hydraulic Copying Attachment (BONDYCOP).



PEGARD

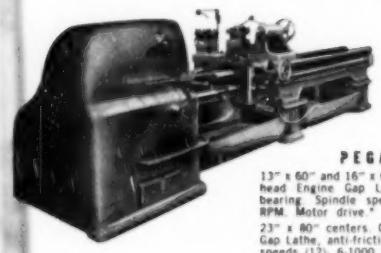
SENSITAST Precision combination toolroom and Copying Lathe. Geared head. 19" x 40" centers. Spindle speeds (18): 27-2200 RPM. Motor drive.



VIKING

13" x 30" and 13" x 40" centers. Engine Gap Lathes, anti-friction bearing. Spindle speeds (infinitely variable): 38-1200 RPM. Motor drive.

PROMPT DELIVERY WITHOUT PRIORITY



PEGARD

13" x 60" and 16" x 60" centers. Geared head Engine Gap Lathes, anti-friction bearing. Spindle speeds (16): 38-2000 RPM. Motor drive.*

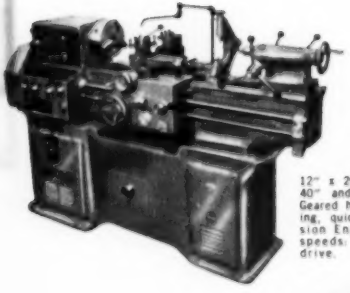
23" x 80" centers. Geared head Engine Gap Lathe, anti-friction bearing. Spindle speeds (12): 6-1000 RPM. Motor drive.*

27" x 120" centers. Geared head Engine Gap Lathe, anti-friction bearing. Hardened and ground steel bedways. Spindle speeds (12): 6-1000 RPM. Motor drive.

*These machines are available with hardened steel bedways as extras.

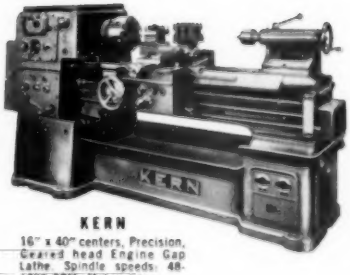
SIMPLEX

14" x 30" and 14" x 40" centers. Engine Gap Lathes, quick change gear. Spindle speeds (12): 47-950 RPM. Motor drive.



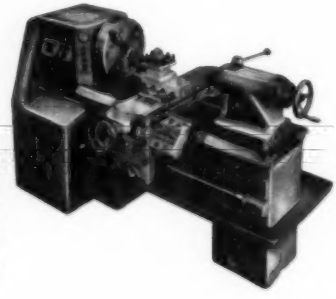
STAR

12" x 20", 12" x 30", 12" x 40" and 14" x 50" centers. Geared head, anti-friction bearing, quick change gear, Precision Engine Lathes. Spindle speeds: 60-1800 RPM. Motor drive.



KERN

16" x 40" centers, Precision, Geared head Engine Gap Lathe. Spindle speeds: 48-1200 RPM. Motor drive.



MUELLER

19" x 40" centers. Production Lathe. Spindle speeds: 250-1500 RPM. Motor drive.

19" x 40" centers. Production Lathe. Hydraulic Tracer controlled. Spindle speeds: 250-1500 RPM. Motor drive.

24" x 30" centers. "Electromatic" Production Lathe. Spindle speeds (infinitely variable): 50-750 RPM. CONSTANT CUTTING SPEED. Motor drive . . . Also available with Transverse Copying Attachment.

24" x 60" centers. Production Lathe. Hydraulic Tracer controlled. Spindle speeds: 50-560 RPM. Motor drive.

MOREY

MILLING MACHINES

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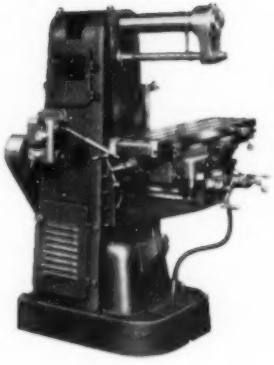
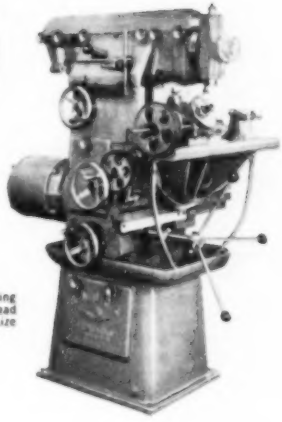


HERO

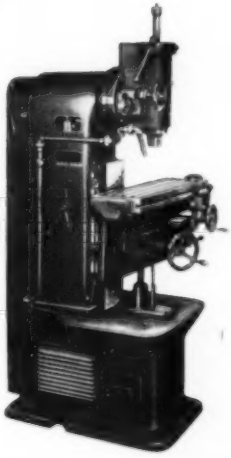
Model 4P Plain Horizontal Milling Machine. Table size 30" x 9¼". Longitudinal table traverse 20". 2 HP Motor Drive.

Model 4U Universal Horizontal Milling Machine. Table size 30" x 9¼". Longitudinal table traverse 20". 2 HP Motor Drive.



S.A.B.C.A.

Model JRC2 Vertical Milling Machine with Swivel Head and Swivel Table. Table size 30" x 9½". Motor Drive.



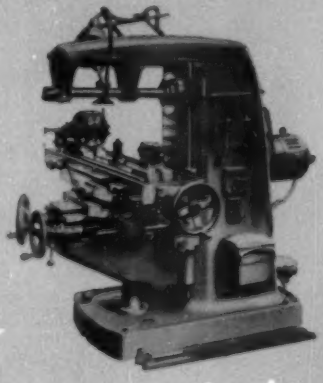
STEINEL

Model 1V 4D Universal Head Vertical Milling Machine, Swivel head. Table size 29" x 8". 1½ HP Motor Drive.

Model 1H 4A Hand Feed Horizontal Milling Machine. Table size 29" x 30". 1½ HP Motor Drive.

MOREY brings you these world famous milling machines from Europe's leading manufacturers . . . Prompt deliveries without priority!

Powerful, accurate new production and toolroom equipment — Plain and Universal types, Horizontal or Vertical. They are extremely flexible machines designed and built for heavy duty . . . And backed by MOREY, builders, rebuilders and distributors of machine tools for over 40 years.

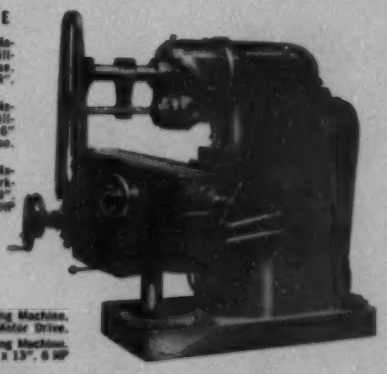


HURE

Model 73 Universal Milling Machine; swiveling Universal Milling Head. Power Rapid Traverse. Table size 57-3/32" x 12-13/64". 5 HP Motor Drive.

Model 74 Universal Milling Machine; swiveling universal milling head. Table size 64-15/16" x 13". Power Rapid Traverse. 6 HP Motor Drive.

Model V234 Vertical Milling Machine; swivel head type. Working surface 63" x 14-61/64". Power Rapid Traverse. 7 HP Motor Drive.



JASPAR

Model 2CR Universal Horizontal Milling Machine. Table size 31½" x 6¾". 2½ HP Motor Drive.

Model 3CS Universal Horizontal Milling Machine. Power rapid traverse. Table size 40" x 13". 6 HP Motor Drive.

Model 3CR Universal Horizontal Milling Machine. Table size 52" x 13". 5 HP Motor Drive.

Model 3CRD Universal Horizontal Milling Machine. Table size 52¾" x 13". Power rapid traverse. 6 HP Motor Drive.

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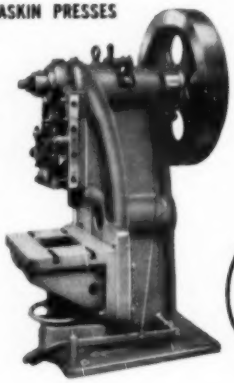
WORLD FAMOUS

RASKIN PRESSES

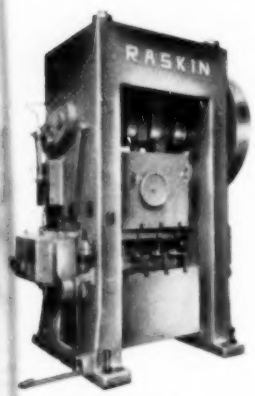
Only a handful of the top quality presses from one of Europe's leading manufacturers! We're ready to meet your requirements with this ruggedly built equipment of the most modern design.

CHECK THE FEATURES OF THESE RASKIN PRESSES

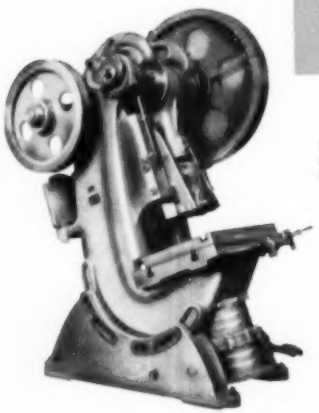
- **Fully seasoned high tensile castings.**
- **Crankshafts of nickel-chrome Molybdenum steel with a 126,000 lb. tensile and 16% elongation.**
- **Extra long gibs for longer die life.**
- **Protected from overload by shear pins in the clutch.**



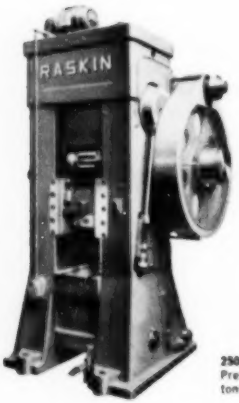
50-ton Horn Press with adjustable and swivel table. From 20 to 120 tons.



150-ton Double Crank High Production Straight Side Press from 30 to 500 tons.



77-ton Geared Press, O.B.I. From 6 to 110 tons.



250-ton Knuckle Joint Press from 125 to 1000 tons.

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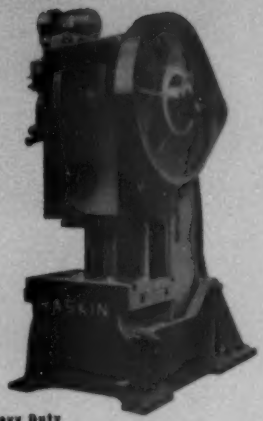
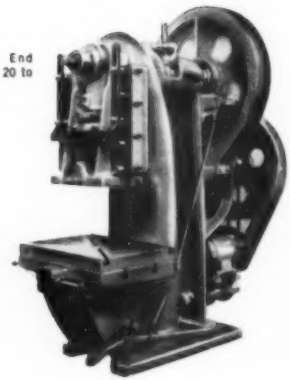
300-ton Double Crank Straight Side Press from 30 to 500 tons.



110-ton Heavy Duty Geared Press, O.B.I.

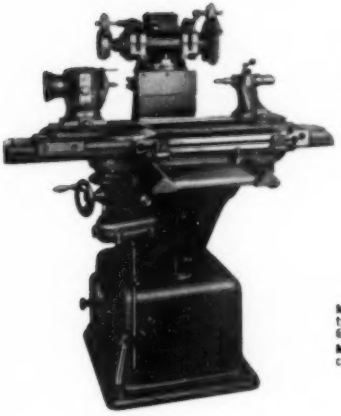


120-ton Geared End Wheel Press. From 20 to 300 tons.

MOREY

GRINDING MACHINES

. . . For Every Requirement!



HAHN & KOLB

Model W1R-0 Universal Tool & Cutter Grinder. Centers swing 10" diameter. Takes 19⅛" in length. Table travel: 16". Motor drive.

HAHN & KOLB

Model LHD-0 Hydraulic Lapping Machine. Lapping wheel dia. (Max.): 16". Max. distance between cast iron lapping wheels: 3¼". Motor drive.

HAHN & KOLB (Not Illustrated)

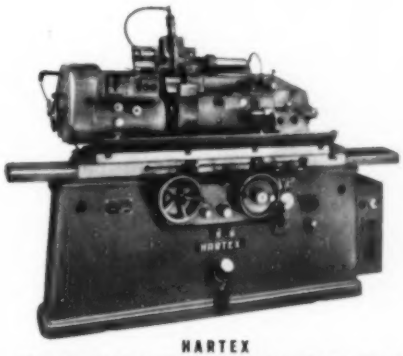
Model E2: Tool Grinding & Lapping Machine. Pedestal type with motor in pedestal base. Wheel diameter 6". Motor drive.

Model 0S 11a: Precision Twist Drill Grinding Machine. Pedestal type. Motor drive.

PROMPT DELIVERY WITHOUT PRIORITY

HERMAN KIRCHNER

Model RS785c: Plane-parallel Snap Gauge Grinding Machine. Max. snap gauge cap. 20". Min. 117". Max. length of surface ground: 3.28". Table stroke adjustable: 0—4¾". Motor drive.



HARTEX

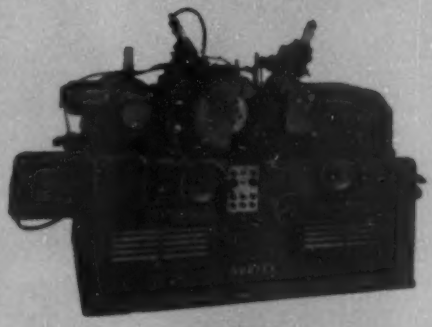
Model RHP-620 Productive Plain Hydraulic Grinder. Max. length of work ground: 24½". Max. swing over table: 15". Grinding wheel 16" x 2". Max. table swivel: 9°. Automatic infeed. Table speeds: variable from 12" to 240" per min. Plunge grinding feeds (6): Plunge rapid reborn. Motor drive.

Model RHP-1630 Productive Plain Hydraulic Cylindrical Grinder (Not Illustrated). Max. length work ground: 40". Max. swing: 13". Grinding wheel: 16" x 2". Max. table swivel: 8°. Automatic infeed variable. Table speeds variable: 12" to 240" per min. Plunge grinding feeds (6). Plunge rapid return variable. Motor drive.

HARTEX

Model RH-630 Universal Hydraulic Grinder. Max. length ground: 24½". Swing: 12". Grinding wheel: 14" x 2". Max. swivel of table: 12°. Table speeds, variable from 12" to 240" per min. Motor drive.

Model RH-1030 Universal Hydraulic Grinder (Not Illustrated). Max. length ground: 40". Swing: 12". Grinding wheel 14" x 2". Max. swivel of table: 8°. Table speeds, variable from 12" to 240" per min. Motor drive.

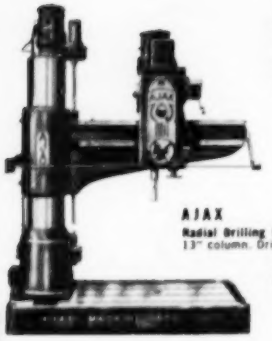


HARTEX

Model 620-C Centerless Grinding Machine. Max. dia. ground: 2". Min.: .06". Standard grinding wheel: 14" x 5". Standard control wheel: 9" x 5". Motor drive.

....for more value!

MISCELLANEOUS MACHINE TOOLS

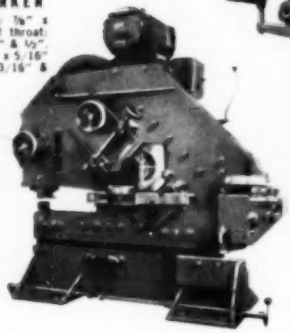


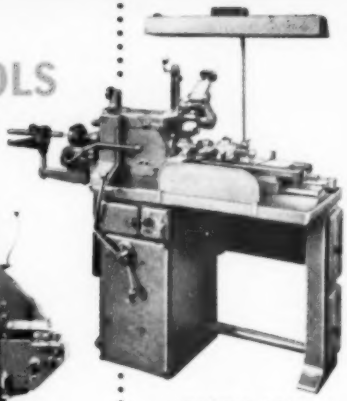
AJAX

Radial Drilling Machine. 4'6" arm x 13" column. Drilling cap.: 2¼" mild steel; 3" cast iron. #4 MT. Spindle speeds (8): 60-1100 RPM. Motor drive.

WORMSER IRON WORKER

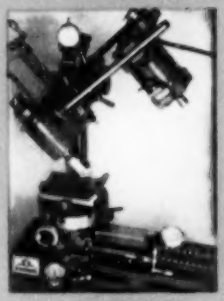
Models T-15 and T-25. Punch: ⅞" x 7/16" & 1" x 9/16". Depth of throat: 14" & 16". Shears plates: 7/16" & ½". Shears angles (square cut): 3½" x 5/16" & 4" x ⅜". Shears round: 1-3/16" & 1⅛". Motor drive.

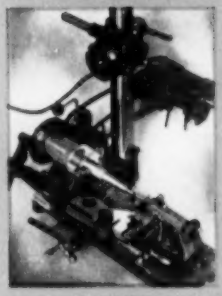




HAHN & KOLB

Model RH-25 High Speed Precision Hand Screw Machine. Max. cap. of bar work: dia. 1" round, 6 holes in turret. Dia. holes: ¾". Max. turning length: 2¼". 81-1200 RPM. 6 spindle speeds. Motor drive.





HOMMEL

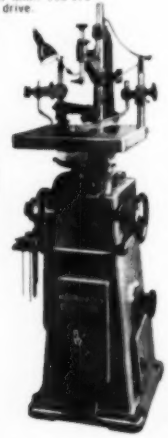
Multi-purpose lathes for turning, milling, drilling and jig boring. Motor drive.

HAHN & KOLB

Model HK-3 SL High Speed Filing & Sawing Machine. Throat gap: 9-1/16". Table size: 15¾" x 15¾". No. of strokes, inf. variable: 71-265. Motor drive.

Model HK-25 H.S. Filing & Sawing Machine (Not illust.). Throat gap: 6¼". Table size: 11" x 11". Stroke speed per min.: 118-170-236-335. Motor drive.

PROMPT DELIVERY WITHOUT PRIORITY



PEGARD

HORIZONTAL BORING MILL

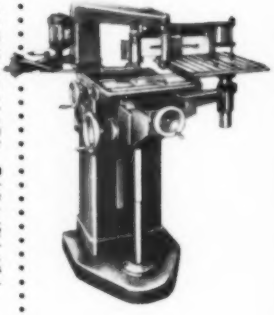
Model U-80: Spindle dia.: 3⅛", #5 M.T. Table dim.: 33" x 49". Max. dist. spindle to table: 37-7/16". Table travel: Longi.: 51". Transv.: 31½". Spindle speeds (18): 10-1600 RPM. Motor drive.

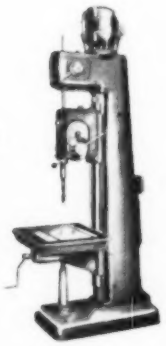
Model U-100: Spindle dia.: 3-15/16", #6 M.T. Table dim.: 47" x 71". Table travel: Longi.: 63"; cross: 63". Dist. spindle to table: 53¼" max. Spindle speeds (18): 7-1400 RPM. Motor drive.

HAHN & KOLB

Model SU Pedestal type Pantograph Engraving Machine. 2 dim. wkg. table: 17" x 12". Panto. movement: Longit.: 12"; trans.: 8". Spindle speeds (6): 2800 - 15,000 RPM. Motor drive.

Model GMO Pantograph Engraving Machine (Bench type) — Not illustrated. Panto. ratio: 1-2 to 1-8. Wkg. table size: 8 x 14. Spindle speeds (4): 5000-12,000. Motor drive.





ALFING

Model BK-25 Heavy Duty Upright Drill. Power feed. Spindle speeds (8): 95-750 RPM. Force-feed lubrication. Motor drive.

NOT ILLUSTRATED:

BJ 12" Metal Cutting Band Saw. Floor type. Hinged table tilting 10° left to right and 10° front to back. Work table: 20¾". Throat: 10¾". Blade speeds (9): From 45½ to 1324 ft. per min. Motor drive.

BONDYCOP Hydraulic Copying Attachment for Engine Lathes. Equipped with motor driven hydraulic pump with tank. Max. tool cross travel: 3". Motor drive.

PRINTED IN U.S.A.

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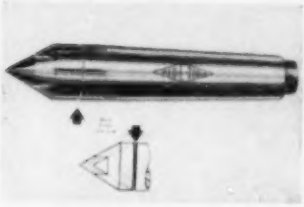
CABLE ADDRESS: WOODWORK, N. Y.

New Equipment at the Tool Show

(Continued from page 246)

Coarse thread series; 6-40 to 1½-12 in the National and Unified Fine thread series; 10-1.0 mm to ⅜-18 in the automotive spark-plug series; 14-1.25 mm to 18-1.5 mm in the aviation spark-plug series; and ⅛-27 to 1-1⅛ in the pipe-thread series. Materials they are available in include iron, steel, aluminum, magnesium, wood, and plastics.

Heli-Coil Corporation, Danbury, Conn.



Carbide-Tipped Centers Have Grinding Safety Life Line

The highly speculative point to which carbide tipped centers can be ground has now been eliminated by the Ready Tool Co. by the addition of a grinding safety life line. The life line indicates the maximum amount that the center can be ground and acts as a warning to the operator when regrinding. The center groove is accurately machined and painted bright red so that the operator will constantly have a guiding line at all times, and the operator can visually see when his grind has gone far enough for safety.

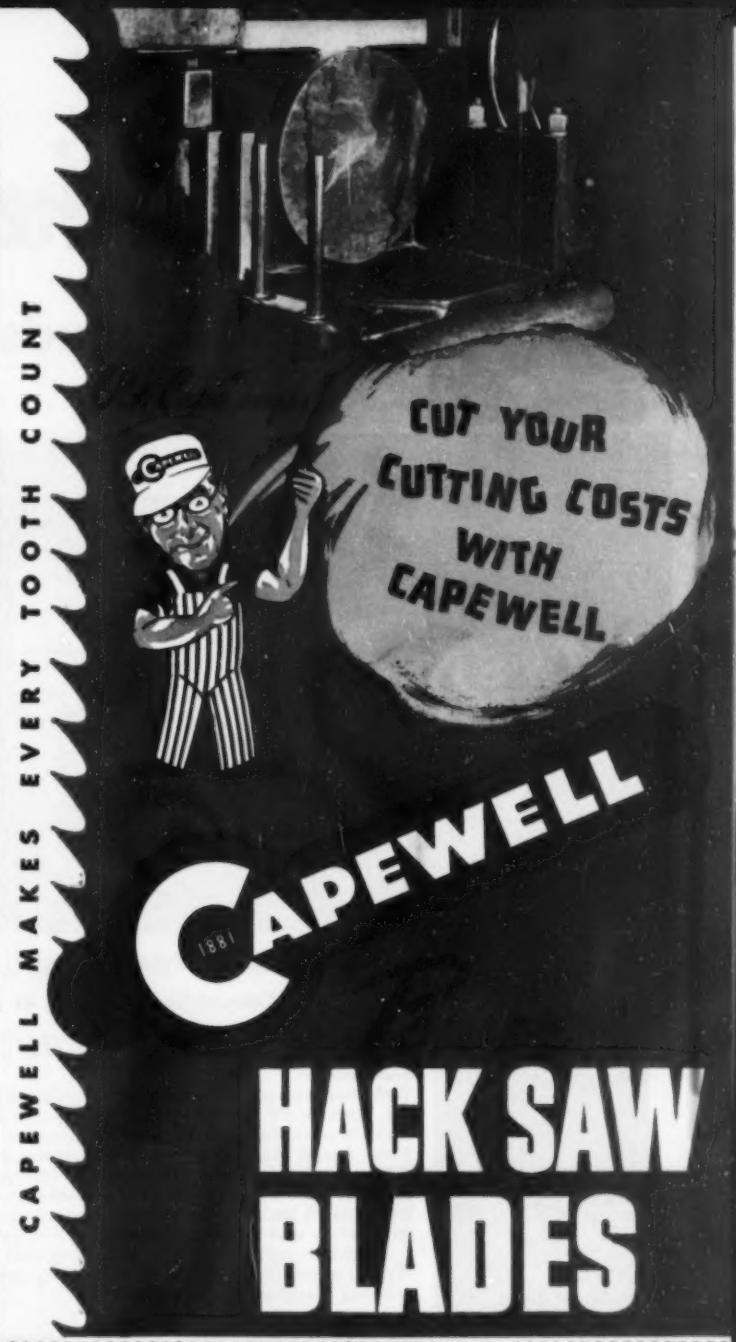
The Red-E safety life line carbide-tipped centers are immediately available in all Morse, Brown & Sharpe, Jarom, Hendy, A.S.A., Norton and Reed tapers and sizes. Also straight shanks.

Ready Tool Co., 55½ Iranistan Ave., Bridgeport, Conn.

V-Block Staging Fixture

Standard staging fixture can be used on AO optical projection comparators, Eastman Kodak contour projectors, Jones and Lamson optical comparators (except Model VC 14), Portman optical comparators, and similar equipment with horizontal illuminators and standard base grooves in their work stages.

Although designed for holding parts having up to ½ in. dia, suitable V's can be easily machined in the fixture. A spring-loaded clamp



THE CAPEWELL MANUFACTURING COMPANY
65 GOVERNOR STREET • HARTFORD 2, CONN.

Please send me your bulletin on Power Hack Saw Blades.

Name _____

Company _____

Address _____

City _____ State _____

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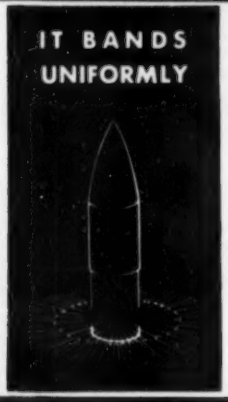
Filling the Breach

at 250 Rounds Per Hour



W-S SEMI-AUTOMATIC SHELL BANDING PRESS

For Conventional Bands or Powdered Metals

Here's a machine that's setting new daily production records right at the shell banding station . . . with rates up to *250 per hour* on 90, 105, 120, and 155 MM ordnance.

With exception of the loading operation, control is entirely automatic. Pressing the "cycle-start" button causes twenty-four synchronized rams to move in radially upon the shell, exert preset pressure, and dwell for an automatically timed period. Another push-button operates the automatic air-ejector.

Where unit work pieces are large and heavy, this kind of mechanized operation and handling pays off in increased man-hour productivity even over extended work periods. The proven design provides the maximum in trouble-free availability and low maintenance . . . You get less rejects. Capacity 500 Tons . . . overall height 3 ft. . . . floor space required 8' 6" x 6' 0".

Write for complete details of this latest revolutionary development in our national preparedness machine.

WATSON-STILLMAN
ESTABLISHED, 1848

HYDRAULIC MACHINERY DIVISION

Factory and Main Office:
163 Aldene Rd., Roselle, N. J.

Branch Off.: 228 N. LaSalle, Chicago Ill. • Manufactured in Canada by Canadian-Vickers, Ltd., Montreal

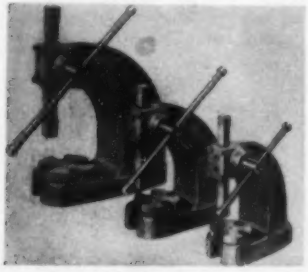
W-S Completeline

HYDRAULICS . . . THE SHORTEST DISTANCE FROM PRODUCTION TO PROFIT

holds the part firmly in the vertical V.

Since the V is vertical, the known centerline of the dia of the part is established regardless of normal dia tolerance varations.

Engineers Specialty Div., The Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 9, N. Y.



Arbor Presses Has Takeup Adjustments

Benchmaster arbor presses in three sizes have capacity up to 2 tons and work clearance up to 9 in. Base and tapered column cast of semi-steel are rated at a safety factor of 5.

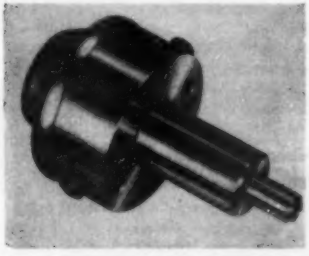
Steel rams and pinions are cut with stub teeth to take high loads. Takeup adjustments are on front and side of ram, and wear compensation adjustments are provided.

Press capacities are listed as:

No.	Ram Travel	Work OD	Force
0	5 in.	7½ in.	½ ton
1	6	10	1
2	9	13¾	2

Threat depth and vertical space are oversize. Actuation can be either by lever or pilot wheel.

Benchmaster Mfg Co., Los Angeles 6, Calif.

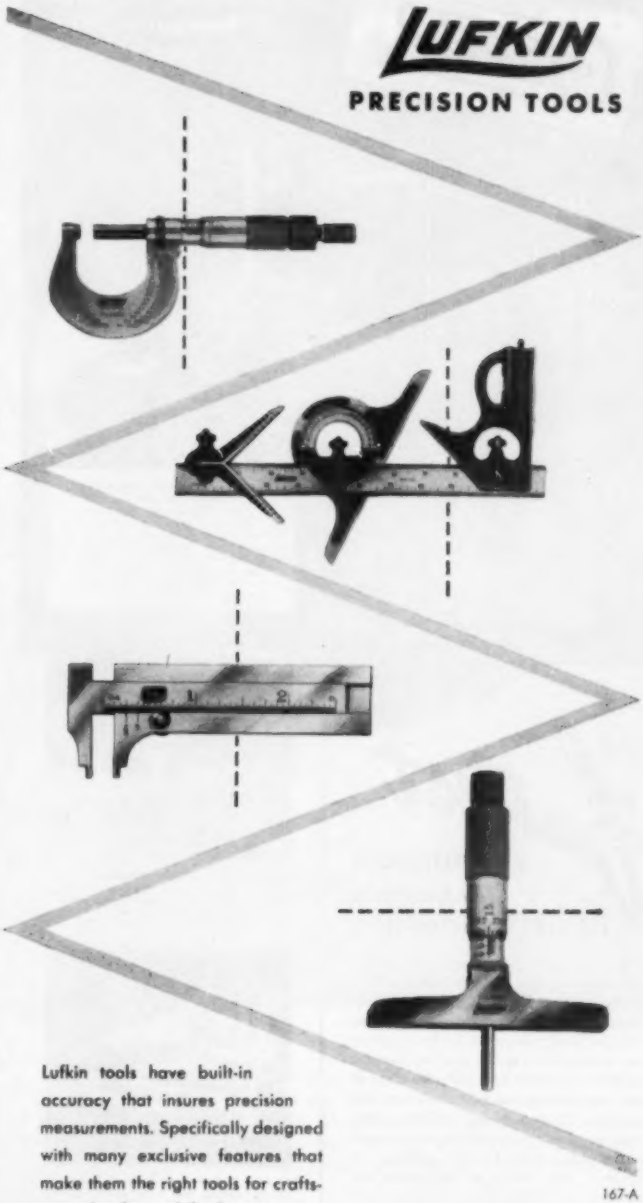


Automatic Reversing Pump Has Only a 2½-in. Outside Diameter

Measuring only 2½-in. OD, by 4¼-in. long, Model RF provides an unusually compact unit of the auto-

the right tools for the craftsman

LUFKIN
PRECISION TOOLS



Lufkin tools have built-in accuracy that insures precision measurements. Specifically designed with many exclusive features that make them the right tools for craftsmen who demand the finest.

167-A

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Onsrud®

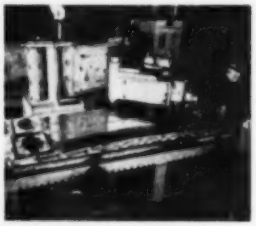
high speed production machines for non-ferrous milling and routing

Onsrud Automatic Contour Milling Machine . . . carriage houses four cutter motors and travels over table. For milling long parts such as spar beams. Cutter motors controlled for position by profile bars . . . for face milling, contour milling, taper milling and the milling of cut-outs.

THE *fastest* PRODUCTION MACHINES IN METALWORKING

When you equip your plant with Onsrud machines . . . you will experience a new kind of speed in milling and routing. Reason for this is that Onsrud machines are specifically designed for the machining of aluminum and related non-ferrous metals . . . built to take full advantage of the characteristics of the metals they will machine. Onsrud design includes super high-speed motors for direct drive to cutters, and fast feeds. Onsrud machines include a wide range of equipment for non-ferrous milling and routing of every type. Your inquiry for information on Onsrud machines specific to your needs is invited.

Onsrud A-24 Milling Machines . . . supplied with vertical or horizontal milling head. Direct drive high speed cutter motors. Horizontal motor designed for "rise and fall" action, under control of profile bar.



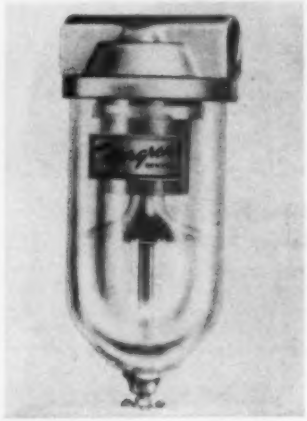
Onsrud Radial Arm Routers . . . for routing stacked flat sheet work. Patterns lay over stacked work and router head is guided manually to cut out work in shape of pattern. Supplied also with drill heads.

ONSRUD MACHINE WORKS, INC.
3900 PALMER STREET · CHICAGO 47, ILLINOIS

matic reversing type which delivers a constant flow from the same port regardless of the direction of shaft rotation, without the use of valves.

It is especially suited to lubricating and hydraulic service in connection with machine tools and attachments. Available in 3 sizes in capacities up to 2 gpm and pressure ranges up to 200 psi max. Other features include external or internal porting, ring or flange mountings.

Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.



Air Filter Removes Corrosion and Scale

Flows up to 140 cfm, pressures to 150 psi, and temperatures from 40F to 120F are recommended operating conditions for Series 22B-6 and -8 filters or ¾- and 1-in. pipe lines. Filtering action with either of three optional elements is automatic.

Standard filter is reinforced 200-mesh (74 micron) Monel screen, but 25- or 64-micron elements are available as alternates. There are no moving parts or cartridges to replace, and cleanout is easy without removing unit from line. Capacity is a quart. Drain cock at bottom opens to blow out refuse.

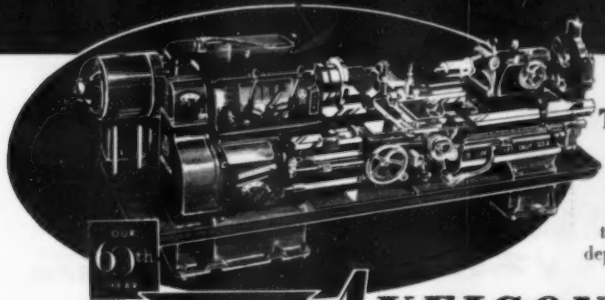
C. A. Norgren Co., 3400 S Elati St., Englewood, Colo.

Jet-Engine-Blade Projection Comparator

This comparator has a 30-in.-dia frosted-glass screen conveniently positioned at the operator's eye level. It provides for minute inspection and measurement of jet-engine and other blade contours.

It is designed to be used with the ESD blade-contour checkers and has a micrometer stage. Contours, thick-

MASSIVE RIGID



OUR 60th YEAR

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

The Axelson spindle is balanced with precision and transmits a smooth flow of power without chatter through all hardened and ground gears. Four large anti-friction bearings are located strategically to control spindle deflection. All Axelson lathes are built to the same high standards which assure accuracy and dependability under heavy and continuous work loads.

AXELSON Lathes

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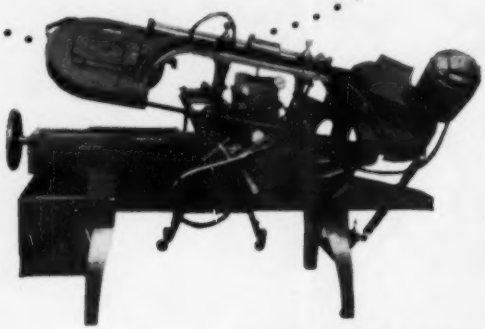
HEAVY DUTY ENGINE LATHES • TOOL ROOM LATHES • GAP BED LATHES

AXELSON MANUFACTURING CO. • LOS ANGELES 58 • NEW YORK 7 • ST. LOUIS 16

Authorized Distributors in All Principal Industrial Centers

Get the advantages of AUTOMATIC BAR STOCK CUT-OFF at a fraction of the cost you might expect



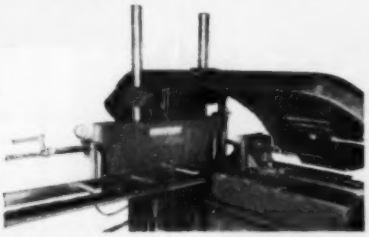
. . . . . with a WELLS SAW and WELLS-O-BAR Feed Master

A set-up for automatic repetitive cutting need not be prohibitively expensive. By combining a Wells Metal Cutting Band Saw and a Wells-O-Bar Feed Master you can automatically cut any quantity of identical lengths of bar stock with a modest investment. Or, a Wells-O-Bar Feed Master can be added to your present horizontal band saw to convert it to an automatic cut-off machine.

For operation the feed unit requires only air at 60 to 80 pounds pressure. Standard feed will project up to 17". The feed mechanism does not interfere with the use of the saw for making single cuts.

See your Wells Dealer for complete information or write direct.

The illustration above shows the Wells-O-Bar unit attached to a Wells No. 8 Saw. At the right is the unit attached to a Wells No. 12 Heavy Duty Machine.



Wells Saws

Wells

The Pioneers of Horizontal

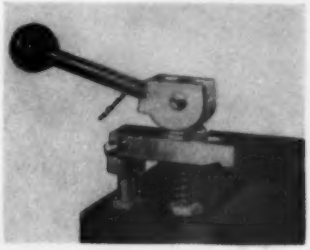
METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
505 ROOSEVELT RD., THREE RIVERS, MICHIGAN

ness, twist, lean, center of gravity, and leading or trailing edges can be measured.

Capacity is for blades having up to 2½-in. chordal width and up to 6 in. between top and bottom gaging sections.

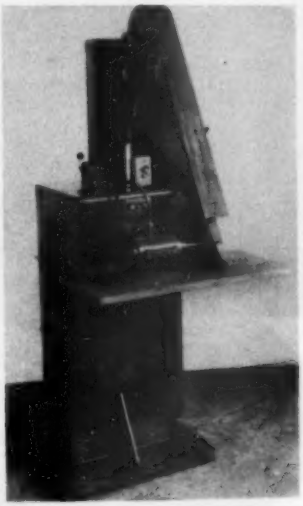
Engineers Specialties Div., The Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 9, N. Y.



Center-Cam Fixture Clamp

This quick-action clamp is designed for holding workpieces. It is rust-proofed and has spherical washers, allowing them to compensate for any irregularities in the work. The clamp is available in five sizes. It can be had with either plastic ball knob or solid steel handle.

West Point Mfg. Co., 36935 West Seven Mile Road, Detroit 19, Mich.

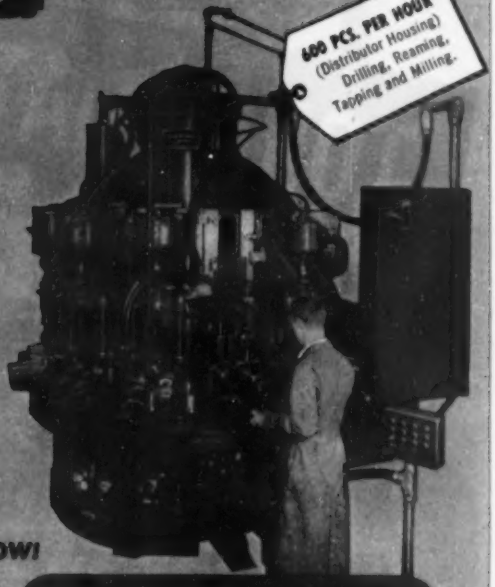


Belt Grinder and Polishing Machine Is Pneumatically Tensioned

The Marschke pneumatically tensioned belt grinder and polishing machine was designed with small contact wheel and high-speed spin-

When it comes to production- come to Hartford Special ..... for

AUTOMATIC DRILLING & TAPPING MACHINES



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HARTFORD *Special*

Hartford Special also makes these production machines

SUPER-SPACERS

Automatic THREAD ROLLERS

DIE POLISHERS

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD 12, CONNECTICUT

FINEST

■ for SPEED

■ for ACCURACY

■ for VERSATILITY

■ for ADAPTABILITY

■ for MAINTENANCE

TORQOMATIC by Jarvis

AN INDUSTRIAL MACHINE FOR INDUSTRIAL USERS

Jarvis POWER TOOLS

TAPPING ATTACHMENTS • TAPS and DIES • ROTARY FILES FLEXIBLE SHAFTS and MACHINES • TUNGSTEN CARBIDE REAMERS and MILLS • DRILLS BORING BITS

Finest for SPEED: Taps more quality threads per hour, more holes than any other tapping attachment.
Finest for ACCURACY: Attaches firmly to drill press or tapping device.
Finest for VERSATILITY: Taps anything from soap to nickel steel without pressure on tap—prolongs tap life.
Finest for ADAPTABILITY: Five sizes, standard or built-in models, will fit any drill press or tapping device. 0-1½" cap.
Finest for MAINTENANCE: Requires little or no maintenance.

TORQOMATICS, when used with Jarvis TAPS, make the finest possible combination for low-cost, high-quality tapping. Send for free, illustrated, descriptive literature to The Charles L. Jarvis Co., Middletown, Conn.

THE CHARLES L. JARVIS CO.
MIDDLETOWN IN CONNECTICUT

dle for off-hand clean-up operation on contoured surfaces of small work pieces. Small-diameter contact wheels were used for access to relatively small concave contours in combination with standard acceptable belt speeds. The contact wheel is quickly interchangeable without need of manual adjustments.

Power is applied from the motor mounted on the floor plate of the base. The contact wheels are in effect one of the idler pulleys instead of a combination contact wheel and driver. Heat is quickly dissipated, both from the belt and contact wheel of the machine. An idler at the top of the machine supplies the belt tension by means of an accurately controlled pressure of the air cylinder coupled to the idler yoke. This idler automatically adjusts itself to the right position and maintains constant belt tension without changing the setting of the air control. This belt tension is maintained automatically regardless of the diameter of the contact wheel.

The spindle is fitted with superprecision, preloaded ball bearings with ample provision for both the radial and axial loads developed. Each spindle is dynamically balanced and it is the same type used on higher priced internal grinders. Spindle housing and caps are designed to prevent entrance of grit and bearings are automatically lubricated with an atomized fog of light oil, created and injected into the housing by air pressure.

Belt-tracking adjustment is supplied by mounting the upper idler pulley on a swivel plate adjusted by a bell arm at the rear of the machine and controlled by the operation of a conveniently located hand grip on the front face of the machine through a pair of conventional shafts and bevel gears. The belt lines up quickly to right or left in response to a turn of the hand grip.

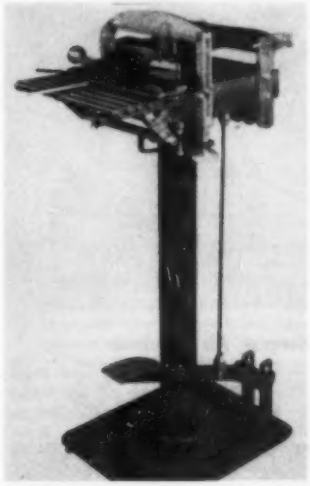
Operating controls are located conveniently on the front top of the base, starting and stopping the machine, supplying and releasing belt tension, tracking and replacing belts are the only operating details of the machine.

The motor is a 1½-hp, 3450-rpm, 220-440 volts, 60-cycle, 3-phase totally enclosed with 5¼ x 2 in. flanged-drive pulley. The controls are manual with start and stop pushbutton having thermal overload protection. The air system includes air filter, pressure regulator, lubricator, hand-operated valve supplying air to 2x6 in. air cylinder and a branch line with solenoid-op-

erated control valves, regulator to supply air-oil fog lubrication to the spindle unit. Lubrication is automatic when machine is in operation, and is discontinued when the motor is shut down.

Weight of the machine is 750 lb net. Floor space needed is 32x30 in., plus approximately 12 in. for belt guard. Door clearance height is 72 in.

Vonnegut Moulder Corp., 1811 Madison Ave., Indianapolis 25, Ind.



Floor-Stand Bender Forms 18-Gage Steel

The Bendit metal-forming machine has capacity for 15-in. widths of 18-gage steel, and ⅛-in. strip ⅝ in. wide. Bend radii can be from 1.32 to ⅝ in., or larger with special bars attached.

The machine is pedal-operated, and is simple in construction. Clamping-bending blades are interchangeable. A toggle-action lever lowers and locks the work-clamping bar. Springs partly balance the clamping mechanism to make operation easier.

Bend angles are controlled by a screw and locknut at the right of the table. An extension table and second work gage are available as extra equipment.

Kilham Engineering, Inc. Plainville, Mass.

Identification photos made with a Polaroid Land camera equipped with an adapter for personnel work can be incorporated into duplicate badges in a minute and a half with Badge Master hand press. Serial

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THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

Many production slow-downs due to excessive drill costs and imperfect holes can be eliminated by using the method proven best for sharpening drills — machine grinding. OLIVER Drill Pointers give balanced cuts with each lip doing equal work—eliminating these excessive drill costs and imperfect holes which can usually be traced to improper drill point grinding. Drills, when properly machine ground, give far better performance than when ground by hand. Remember — twist drills should be removed from the drilling machine and replaced at the first sign of dullness — prompt attention to this condition, along with careful machine grinding, will increase their wearing life and accuracy. To produce more perfect holes with your drills . . . BE WISE, OLIVERize . . . Use OLIVER Drill Pointers.

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No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.

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Numbers can be impressed at the same time. The speed eliminates extensive paper work; the method is simple enough to be handled by untrained personnel.

Anderson & Sons, Inc., Westfield, Mass.

Norgren Air Regulator

Series 11,400-2 is a precision regulator, relieving type of air valve for applications on air-controlled instruments and for inert-gas lines. Maximum pressure is 400 psi, delivery pressure is zero to 30 psi or 50 with an adjusting spring, and thread size is ¼ in.

The built-in relieving feature is a safeguard for delicate instruments and mechanisms. The relief-valve seat is Nylon to provide better life; and a Nylon ball is used. The diaphragm is rubber reinforced with Nylon. Disassembly can be completed without removing the valve from the line.

C. A. Norgren Co., 3400 E Elati St., Englewood, Colo.

Threaded Cone Extends Three Pins On Swiss Internal Micrometer

Three feelers slide in a measuring head, being pushed outward by a screw-threaded taper. The pitch of the screw cut on this taper also serves as the micrometer measuring screw. All the movable elements are brought together in the measuring head, with the spindle and feelers forming a rigid whole. The principle of direct measuring is therefore realized.

The spindle and feelers are made of hardened and ground steel with the feelers supported at exact right angles to the taper, thus avoiding

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Cut-ability . . . that's the word for "Red End" Power Blades! *Cut-ability* that starts with special Simonds hack-saw steel, double checked for toughness and grain structure. *Cut-ability* that proves out *and pays off* on the job with straight fast cuts and *more cuts* per blade. Supplied in all standard sizes with a choice of these two types of steel:

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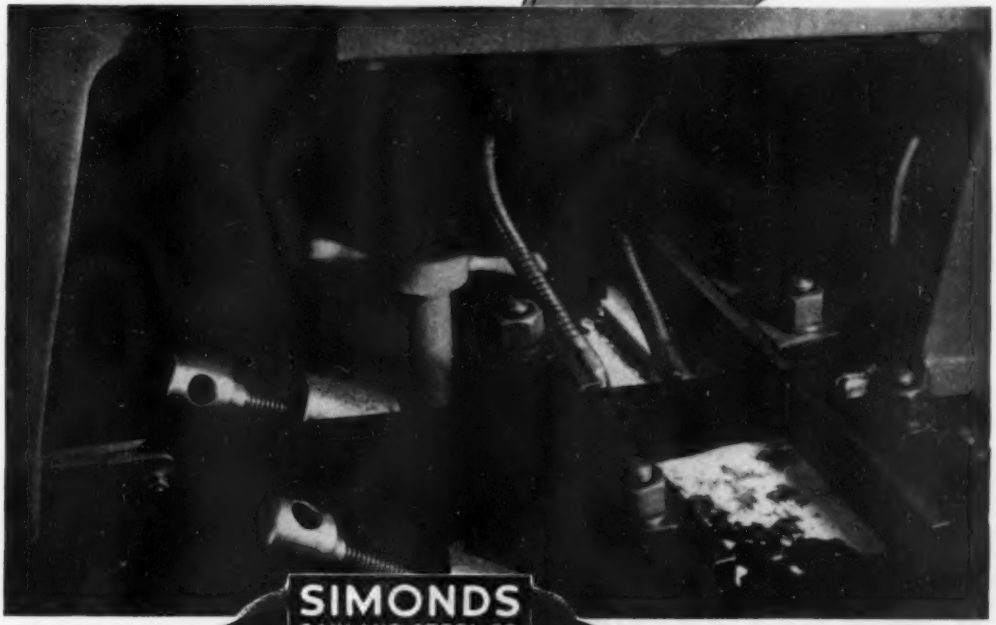

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FUTURE
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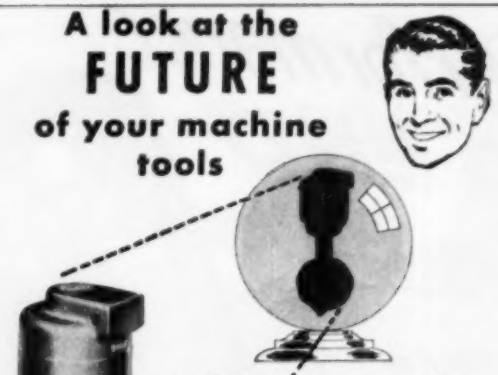

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Ruthman Gusher Coolant Pumps are simple in construction with fewer parts to wear. They're electronically balanced to cut vibration to a minimum, assuring long trouble-free life with less maintenance costs. Write today for our catalog of sizes and models available.

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1818 Reading Road, Cincinnati, Ohio

excess friction in their guides. The feelers are spaced 120° apart.

A ratchet limits the pressure that the operator can apply and also produces slight vibrations that help in seating the gage in the bore.

Known as the Imicro, the gage is not moved back and forward in the bore as is a plug gage. Wear is therefore reduced to a minimum. It can however be checked for wear by gage rings supplied with the instruments.

The absolute accuracy of reading on the micrometer drum is said to be 0.0002 in. and tests prove it is possible to measure with a tolerance of 0.0001 in. Deep bores can be measured by adding an extension tube. Relieving (backing off) may also be measured to a certain degree, depending upon gage size.

The actual measuring is simple: The gage is placed in the bore, the ratchet turned until it disengages, and the result read off.

Therefore four sets available, with measuring ranges per set of 0.5 to 0.8, 0.8 to 1.6, 1.6 to 4.0, and 4.0 to 8.0 in. There are 3 gages in the first set, then 4, 6, and 4 apiece in the others.

Imported by:

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by the originators of "Die-less Duplicating"
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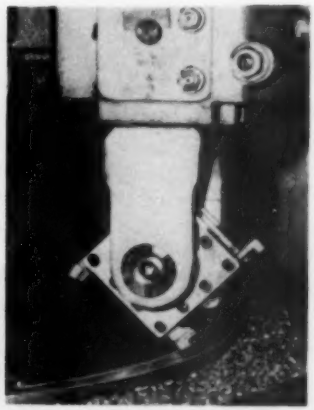

Davis Eight-Position Toolholder For Vertical Boring

For use on vertical boring and turning mills, this toolholder requires only one simple wrench adjustment to change position. It enables an operator to turn, undercut, bore, and chamfer with one setup. Four tools can be mounted at once, with positive position assured by two index pins. Accuracy is attained by the massive cast-steel body of the holder.

One simple wrench adjustment

Ideally Tooled

for Ordnance today... with a weather eye open for quick changeover later

First and foremost, machine tools are dedicated to defense production... but there's every reason why skilled designers should also look to the future. Bodine automatic, dial type machines are constructed basically to produce *more* in a *shorter time*... to give every operator the highest production, with precision automatically controlled. Yet a simple changeover of tooling when the time comes will convert them for highly profitable industrial production of the same nature.

For instance, this Bodine NO. 42-30 is tooled to produce an ordnance component, but it can just as well be adapted for any combination of Milling, Drilling, Tapping, Screw Inserting, Staking, or assembly operations... for processing thousands of parts for industry.

If you need equipment for high speed, repetitive processing, ask Bodine engineers for specific recommendations.

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Working with a wide variety of band and power hack saw machines, Milford Specialists continually test MILFORD Blades under both normal and severe break-down conditions. The carefully tabulated results contribute substantially to the development of MILFORD Blades that give you maximum performance in the type of metal you cut. MILFORD Specialists make your metal cutting problems theirs. If necessary, special tests are conducted on your material to make sure you get maximum production at the lowest cost.

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PROFILE AND BAND SAW BLADES
HAND AND POWER HACK SAW BLADES

will change position through 360° in accurately indexed increments of 45°. A center pin locks the assembly in alignment and clamps it solidly. Result is decreased setup time.

Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

Powered Spring Coiler Added to Perkins Line

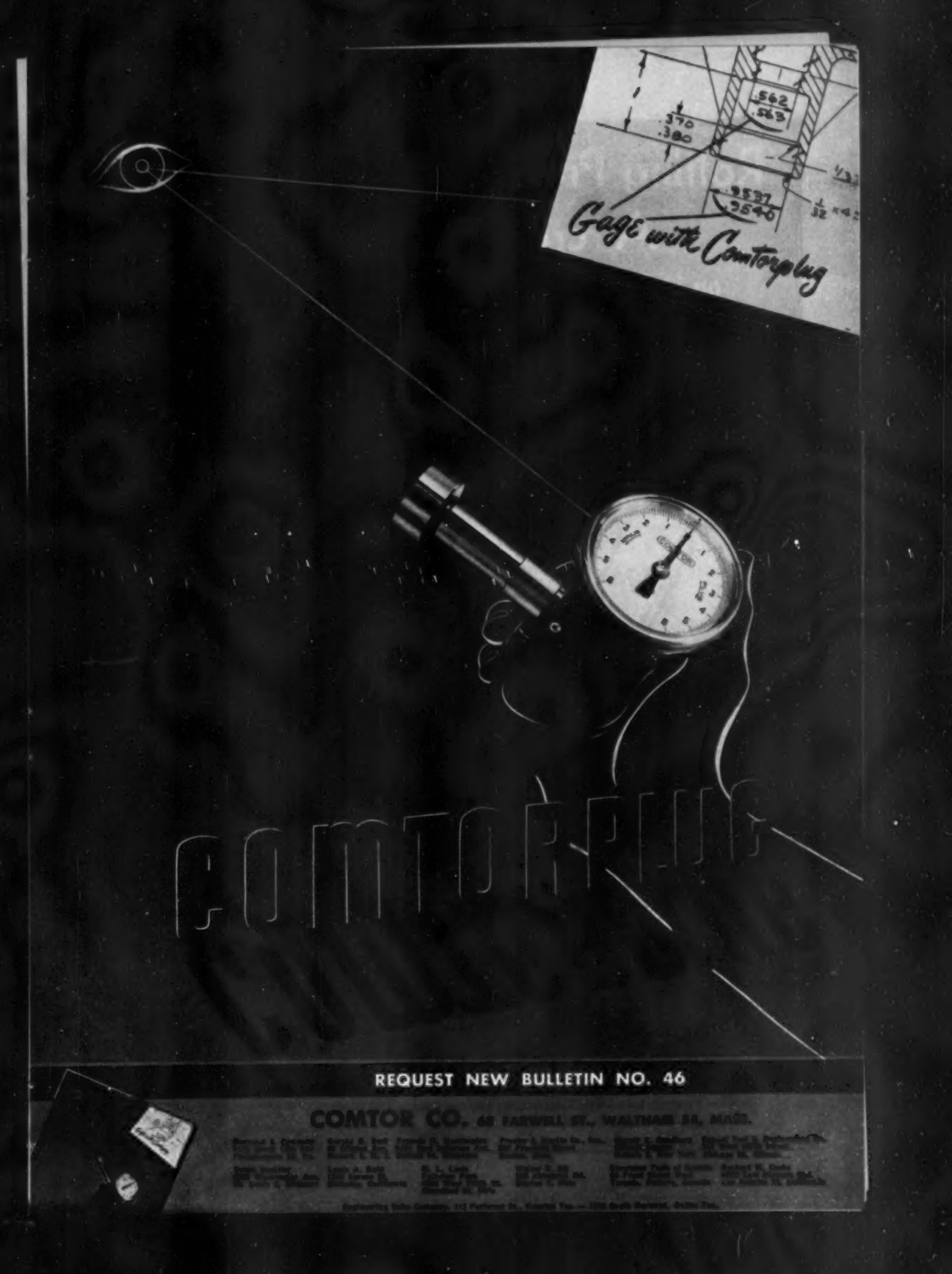
A ¼-hp motor drives Perkins' spring coiler, which has the same head as the hand model except for new bearings and gears. Stock from 0.005 to 0.125 in. in dia can be formed into torsion, compression, extension, and tapered springs without arbor changes.

Springs are made with or without initial tension and with open or closed ends. Tapered coils or coils with changes in OD are formed by adjusting a screw during the coiling operation. A second adjustment screw controls coil pitch. Either can be operated during a run by disengaging the motor with a foot brake control. Base size is 23 by 22½ in.

Perkins Machine & Gear Co., Springfield, Mass.

Crimped Handle on Safety Hammer Prevents Copper Head Coming Off

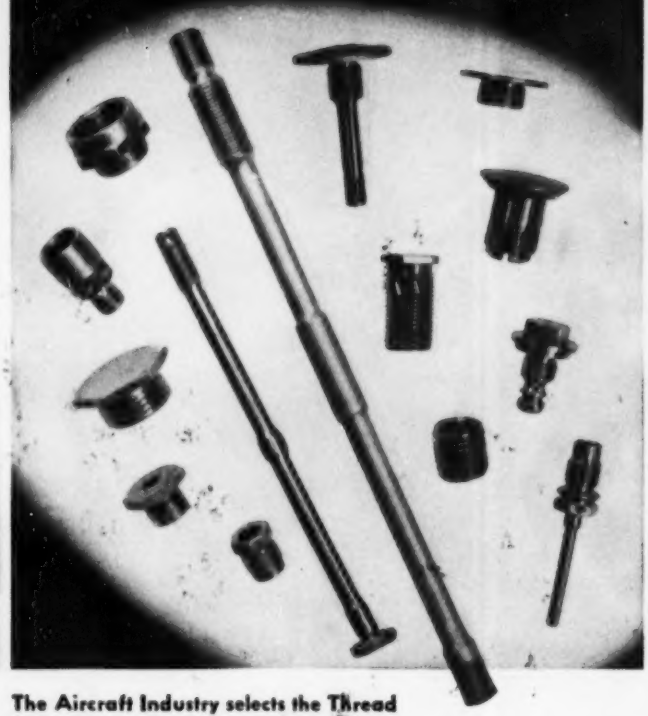
The head is a tough homogeneous casting of copper or copper alloy which will flatten, but not fracture or chip. It is molded on the end of a light-weight, tubular-steel handle, which has been crimped and given a butterfly twist inside the head. This eliminates the use of wedges and pre-



REQUEST NEW BULLETIN NO. 46

COMTOR CO. 65 FARWELL ST., WALTHAM 54, MASS.

Rolling Precision Aircraft Parts on REED Cylindrical Die Thread Rollers



The Aircraft Industry selects the Thread Rolling Process as the preferred method of threading aircraft parts.

Thread rolling reproduces the precision thread form of the thread rolling dies and maintains the original accuracy of the setup over long runs.

The cold forging action of thread rolling produces a thread that is substantially stronger and tougher than similar threads produced by other processes.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

Manufacturers of

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Worcester, Massachusetts, U. S. A.

vents the head from loosening or coming off.

The handle is resilient enough to give slightly on the force of impact. The grip is diamond knurled and oval shaped to provide a positive grip. Known as Safe-T-Hammers, they are stocked in 14 sizes from ¼ lb. to 15 lb.

Univertical Machine Co., 109 West Pleasant Ave., River Rouge, Detroit 18, Mich.

Sabca Universal-Horizontal Milling Machine

The SABCA Model JRC2 miller has a table size of 30 x 9½ in. Vertical table size is 29½ in. x 11 in. Longitudinal table travel for both hand and power drive is 12½ in. There are 12 spindle speeds ranging from 48 to 2826 rpm. It is available with swivel head, swivel table, and many attachments. Imported by:

Morey Machinery Co. Inc., 410 Broome St., New York 13, N. Y.

Magnification checker and scale is for use on all makes of optical comparators and profile projectors. It uses a new reticle principle to accurately check the magnification of comparators at 10, 20, 25, 31.25, 50, 62.5, and 100x. A special reticle is included which aids in centering crossline and similar screens.

Engineers Specialty Div., The Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 9, N. Y.

Tangent die heads have been developed for specific application to Brown & Sharpes. They are equipped with Duallife chasers. Threading

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STERLING SLO-SPEED!

We have recently modernized our Radial Drill Press by replacing the old cone pulley with a 334 to 1336 RPM Sterling Speed-Trol and are now getting the production from this old press that we would from a new modern press ...we estimate savings of $1,000 to $1,200 over purchasing a new drill press. We recommend Sterling Speed-Trol for modernizing machine tool drives, reports Chas. W. Hiers of New Orleans Armature Works.

STERLING SLO-SPEED GIVES YOU THE ONE BEST LOW SPEED AND

gives uninterrupted service—carries heavy overhung loads—provides versatile mounting and flexibility in arrangement of machinery—saves valuable space—provides greater safety—costs less to install and use. An indispensable source of low speed power for:

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OTHER STERLING ELECTRIC POWER DRIVES:

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70 ILLUSTRATIONS showing how Sterling Electric Power Drives reduce production costs. Write for Bulletin No. C-100.

STERLING ELECTRIC MOTORS

Plants: New York City 51; Van Wert, Ohio; Los Angeles 22; Hamilton, Canada; Santiago, Chile.
Offices and distributors in all principal cities.

with Dual-life chasers. Threading with the die heads can be done with speeds up to 3500 rpm.

Jones & Lamson Machine Co., 7810 Woodward Ave., Springfield, Vt.

Carbide-Tipped Side Milling Cutters with Stagger Teeth

Line of stagger-tooth side milling cutters have a Tri-Helix tooth design. Carbide tips with a Tri-Helix grind are said to fold the chips away from the work permitting high table feeds and heavy cuts in difficult steels.

The cutters are available for cutting slots between ¾ and 1⅜ in. wide.

Nelco Tool Co., Manchester, Conn.

ROUND TABLE Discussion

FOUR EYES

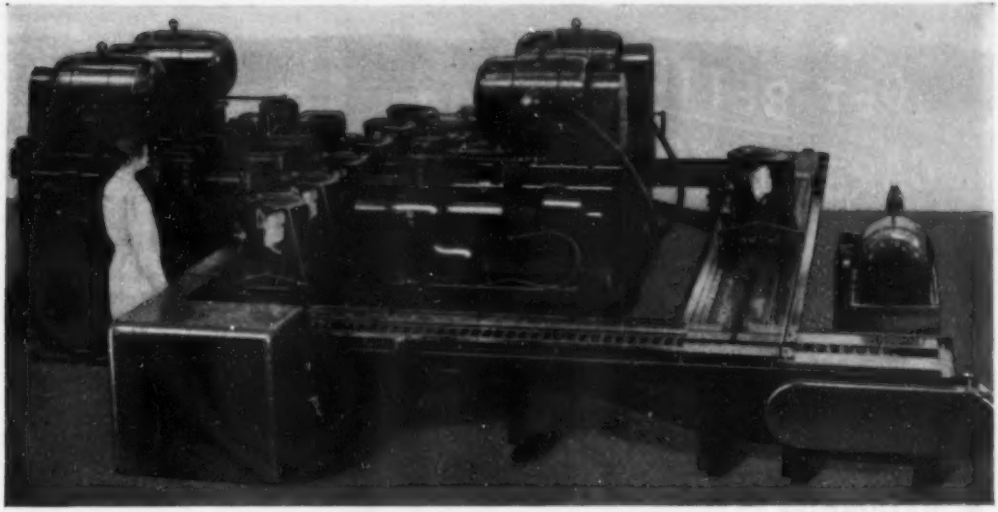
WHOSE BUSINESS is a shopman's need for glasses—or hearing aids? Is his pride more important than plant efficiency? Is it worth the money for the company to provide such services? Our readers' opinions—

PRIMARILY, the question of good eyesight, as well as hearing, is a matter for the individual. His life, as well as his livelihood, may depend upon it.

At the same time, a prospective employer has a real interest in the possession of eyesight particularly. In employing men, he needs individuals who are as nearly 100% efficient as possible and that employer would be wise who seeks to ascertain what that standard is, before men are engaged.

In Britain it is the practice in many works that all prospective employees have to pass the doctor before engagement. Any weaknesses of this kind, which can be remedied by appropriate treatment, must be sought either before engagement or within a specified time afterwards, the doctor being the authority in such cases.

A man with poor sight is unlikely to be one of the best workmen, because quality of work, as well as speed, are likely to be affected. The



Cross Transfer-matic, with 10 Howell motors, helps speed aircraft production.

Drills, bores 80 cylinder heads per hour!

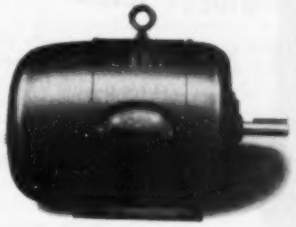
This Cross Transfer-matic drills and bores 80 aircraft engine cylinder heads per hour! That means a lot of engines for military or civilian planes.

Built for one of the industry's leading manufacturers, this machine automatically rough drills and forms valve pockets and spring compartments, and finish bores valve guide holes and valve insert and spring seats. The whole operation takes only 45 seconds!

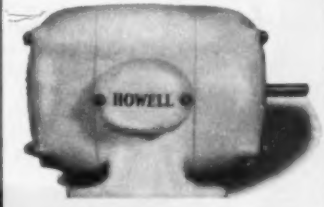
Ten precision-built Howell motors, ranging in size from one to 30 H.P., were specified to drive the spindles, the hydraulic and coolant pumps, and the chip and fixture conveyors. Each Howell motor was chosen to fit its job exactly.

Howell engineers will be glad to work with you, too, to get top performance from your electric motor installations. They will design special motors if required, or recommend Howell motors in standard NEMA frame sizes from 1/6 to 200 H.P. So, for every job, especially your toughest ones, get in touch with the Howell representative in your city, or write directly to us today.

HOWELL ELECTRIC MOTORS COMPANY
Howell, Michigan



HOWELL Type K Motor. Offers constant performance in the presence of dirt, dust, fumes and moisture. Sizes from 3 to 150 H.P. at 1800 R.P.M. Either vertical or horizontal mounting.



HOWELL Sanitary Motors meet the most exacting standards of the dairy and food industries. They contain no pockets, cracks, or crevices. Available for vertical or horizontal mounting.

HOWELL Red Band MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.
Precision-built industrial motors since 1915

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No matter where you're located there's a Wendt-Sonis distributor within helping distance. W-S carefully selects distributors who know industry, production and carbide cutting tools. You can depend on your W-S distributor!

WIDEST SELECTION OF STANDARD TOOLS

Wendt-Sonis offers only the best from which to choose. Select the right tool for the job from the W-S family of more than 1,000 standard carbide cutting tools. W-S offers extra economies, faster tool delivery when you rely on carbide grade equivalents.

MORE "AIDS" TO PRODUCTION

Wendt-Sonis is known throughout industry as an outstanding source for important production aids. Currently available on request: Chip Breaker Chart, Reaming Instruction Chart, Carbide Grade Recommendation Chart, Feed and Speed Calculator, Decimal Equivalent Chart. Ask your W-S distributor to show you the complete line of carbide cutting tools from 72-page W-S catalog, or write WENDT-SONIS COMPANY, HANNIBAL, MISSOURI for complimentary copy.

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CARBIDE CUTTING TOOLS

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DRILLS • END MILLS • BURS • TOOL BITS • SOLID CARBIDE TOOLS • REAMERS
ROLLER TURNING TOOLS • THREADING TOOLS • SPECIAL TOOLS

unfortunate position is that many men are not aware of the causes of their troubles and assume that poor sight, like poor health, is a state which must be borne.

An example in the writer's experience may be of interest. A man who worked for years near him asked him one day if he would check the setting of a micrometer. Thinking this was strange, he asked the man if his sight were not good enough to enable him to read it himself. The answer was no, and that it was getting worse, his sight had always troubled him. Asked why he had not seen an oculist, he said he had thought about it, but he knew it would mean spectacles and that would be telling the firm his sight was bad, and he feared he might then lose his job. The writer persuaded him that he was wrong; got him to see an oculist; spectacles were ordered, obtained, and, in his own words, the world was another place for him.

His spirits went up, as also did the quality and the size of his output, and he was no longer a danger to himself or anybody else.

Firms need not provide spectacles; it is not their responsibility, but they have a right—it may be a duty—to insist that the men they employ, if they have not good eyesight, are provided with all the facilities which science can offer to aid them; a service to both parties.

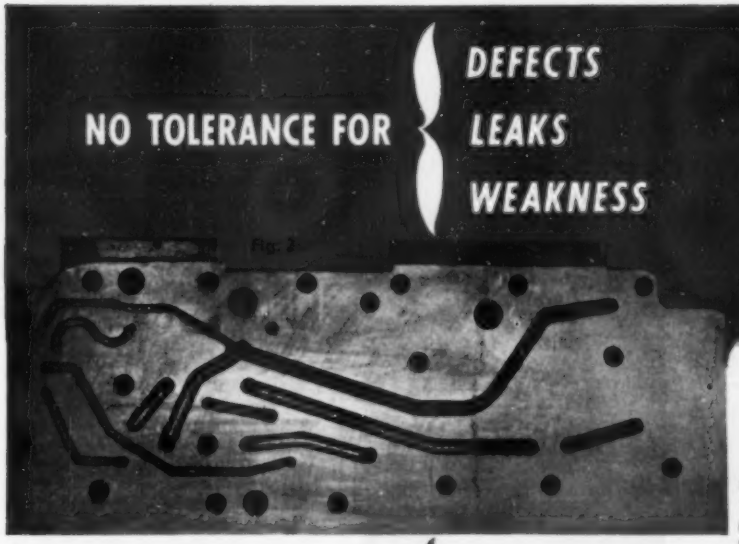
J. E. Powell
Lincoln, England

•

VENDETTA

NATURALLY, the big Swede and the Sicilian each feel that their nationality is superior to others. So do all nations feel superior to all others. That is what makes wars. Any man

NO TOLERANCE FOR DEFECTS LEAKS WEAKNESS



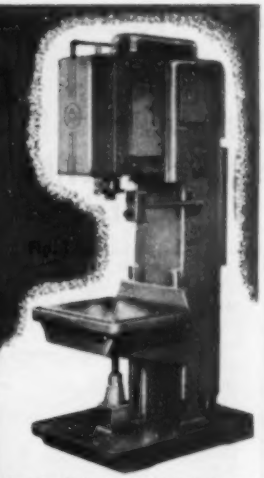


Fig. 1—A Modern Tool Works Limited "Drillmatic".

Fig. 2—The Meehanite hydraulic manifold—the "heart" of the operating and control mechanism.

SPECIFIED MEEHANITE® CASTINGS

Take *YOUR* Casting Problem To A MEEHANITE FOUNDRY

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Crawford & Doherty Foundry Co.	Portland, Oregon
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio and Grove City, Pa.
Empire Pattern & Foundry Co.	Tulsa, Oklahoma
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
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General Foundry & Manufacturing Co.	Flint, Michigan
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The Hamilton Foundry & Machine Co.	Hamilton, Ohio
Hardinge Company, Inc.	New York, New York
Hardinge Manufacturing Co.	York, Pennsylvania
Johnstone Foundries, Inc.	Grove City, Pennsylvania
Kanawha Manufacturing Co.	Charleston, West Virginia
Lincoln Foundry Corp.	Los Angeles, California
E. Long Ltd.	Orillia, Ontario
Otis Elevator Co., Ltd.	Hamilton, Ontario
The Henry Perkins Co.	Bridgewater, Massachusetts
Pohlman Foundry Co., Inc.	Buffalo, New York
Rosedale Foundry & Machine Co.	Pittsburgh, Pennsylvania
Ross-Meehan Foundries,	Chattanooga, Tennessee
Shenango-Penn Mold Co.	Dover, Ohio
Smith Industries, Inc.	Indianapolis, Ind.
Standard Foundry Co.	Worcester, Massachusetts
The Stearns-Roger Manufacturing Co.	Denver, Colorado
Traylor Engineering & Mfg. Co.	Allentown, Pennsylvania
Valley Iron Works, Inc.	St. Paul, Minnesota
Warren Foundry & Pipe Corporation	Phillipsburg, New Jersey

"This advertisement sponsored by foundries listed above."

The hydraulic operating mechanism of this "Drillmatic" drilling machine (Fig. 1) manufactured by Modern Tool Works Limited, Toronto, is of course the functional heart of the machine. Successful performance of such a mechanism is definitely dependent upon the hydraulic manifold (Fig. 2). In this and other types of drilling equipment the manufacturer specifies Meehanite castings for this part because of the design requirements for absolute density and high strength. The manifold is used for gasket mounting of various hydraulic control valves and the castings must withstand 1000 psi during operation.

In addition to this particular component the press shown is built with the following Meehanite castings:

1. **Table**
2. **Table Base**
3. **Fixtures**
4. **Retracting Bush Plates**
5. **Multiple Spindle Drill Head**
6. **Head Adapter**
7. **Motor Support Bracket**
8. **Hydraulic Unit and Base**

In the hydraulic unit the main body and cylinder are cast integrally and in Meehanite metal assure the required resistance to wear, pressure and high strength characteristics.

This equipment is another example of superior design in precision production tools made possible through the dependable and uniform *Quality* characteristics of Meehanite castings.

Write for our new booklet "25 Years of Proof in Service."

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Technical Service Data Sheet

Subject: IMPROVING PAINT ADHESION ON STEEL WITH GRANODINE®

INTRODUCTION

"Granodine" is a zinc phosphate coating chemical which improves paint adhesion on steel, iron and zinc surfaces. In the Granodizing process, a non-metallic crystalline coating is formed on the treated metal. This bond holds and protects the paint finish and thus preserves the metal underneath.

Official Dept. of Defense Photograph

An F4U Corsair with the Navy's new aircraft anti-tank rocket, the "RAM". A Grade I zinc phosphate finish (JAN-C-490) protects the entire external surface of this rocket and provides a durable bond for the specification paint finish.

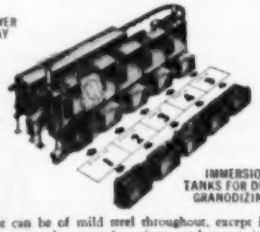
"GRANODINE" MEETS SERVICE SPECIFICATIONS

JAN-C-490, Grade I	CLEANING AND PREPARATION OF FERROUS METAL SURFACES FOR ORGANIC PROTECTIVE COATINGS
JAN-F-495	FINISHES FOR EQUIPMENT HARDWARE
U.S.A. 57-0-2C Type II, Class C	FINISHES, PROTECTIVE, FOR IRON AND STEEL PARTS
U.S.A. 51-70-1, Finish 22.02, Class C	PAINTING AND FINISHING OF FIRE CONTROL INSTRUMENTS; GENERAL SPECIFICATION FOR
MIL-V-3329	VEHICLES, COMBAT, SELF-PROPELLED AND TOWED; GENERAL REQUIREMENTS FOR

GRANODIZING DATA

Granodizing is an easily applied chemical process. Depending on the size, nature and volume of production, Granodizing can be carried out by spraying the parts in successive stages of a power washing machine, by dipping the work in the cleaning, rinsing and coating baths contained in tanks, or by brushing or flow coating the work with portable hand equipment. Typical process sequence and equipment requirements are shown below:

MULTI-STAGE POWER WASHER FOR SPRAY GRANODIZING



IMMERSION TANKS FOR DIP GRANODIZING

PROCESS SEQUENCE

1. Clean
2. Rinse
3. "Granodine"
4. Rinse
5. Final Rinse

NOTE: Equipment can be of mild steel throughout, except in the Granodizing stage, where nozzles, risers, and pump impeller should be of acid-resistant material.

MANY APPLICATIONS

Automobile bodies and sheet metal parts, refrigerators, washing machines, cabinets, etc.; projectiles, rockets, bombs, tanks, trucks, jeeps, containers for small arms, cartridge tanks, 5-gallon gasoline containers, vehicular sheet metal, steel drums and, in general, products constructed of cold-rolled steel in large and continuous production are typical of the many products whose paint finish is protected by "Granodine".

CHEMICALS ACP PROCESSES

WRITE FOR FURTHER INFORMATION ON "GRANODINE" AND YOUR OWN METAL PROTECTION PROBLEMS.

CHEMICALS ACP PROCESSES

will resent bitterly an insult to his nationality. As a matter of fact, every man feels superior to you and to me in some way.

You can hit a man over the head with a blackjack or you can stick a gun in his ribs, but it will not change his mind or make him feel better. These insults, as practiced by the two employees, are often offensive and nauseating. There is a way, however, to clear up a situation like this involving two good workers, without getting tough.

I would suggest that Al call these two employees into the office and tell them all the good things he knows about both Sicily and Sweden. This will immediately make both men feel good. He then proceeds to tell these men they are too sensible to let this misunderstanding interfere in their work and the morale of the department. Al then firmly tells them that he cannot let these things interfere in quality and production and that he would hate to lose two good employees like them. Finally Al has the boys shake hands.

By a few words of praise for each man and his nationality and also by giving the boy a good reputation to live up to, Al has cleared up this situation — without mollycoddling them.

A. E. Salmons
Philadelphia, Pa.

•

WHETHER Al will have to get rough with the boys to snap them out of their childishness is a question. He may, and he may not. That depends largely on the basic psychological set-up of the two men chiefly involved. Probably the best way to find out is precisely the thing Al now proposes to do, that is, to put them to-

"It's only for hands and face—I don't care if you do find it convenient—out!"

gether on a tough job where they will necessarily have to cooperate or fall down on the job.

This will, at least, give Al thoroughly practical ground he can stand on in dealing with the situation. Both men can be kindly but firmly told that no allowance is to be made for any personal differences. Al can tell them he expects a good job on the die involved, and that in a reasonable length of time. He can watch them closely while the job is in process, then crack down on either or both, if and as the need may appear.

Before Al ever puts these two men together, however, he should carefully consider alternatives that may occur, and should pre-decide what he himself will do in each case. Suppose a knockdown-and-dragout fight ensues. Will he fire both men? If not, just what will he do? He should also decide just what he will do in case one man appears willing to go along, and the other insists on perpetuating the trouble. In such a case, it would seem the proper course would certainly be to fire the persistent troublemaker. In any case, Al should fully decide this matter in advance, so there will be no appearance of vacillation in his own behavior should that particular set of circumstances arise.

It could be that Ed is basically right, and yet that there is some truth in Al's position. That is, Al might have to get tough in the end, but not nearly so tough as he would if he went at the matter in some other way. But the idea of putting the two men to work together is certainly strategic from the standpoint of giving Al a natural "in" to a psychological point where he can handle the situation more directly, therefore better.

Al probably just imagines that the

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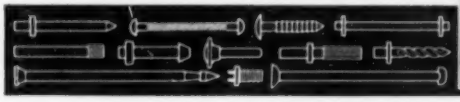
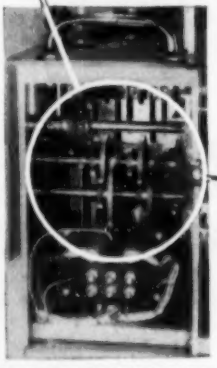


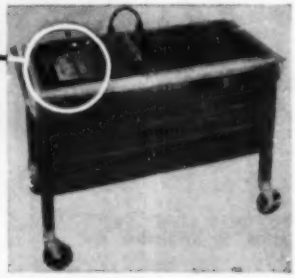
Hassall

Mass. Gears

Applied in Biophysical Research Recorder



The Sanborn Company of Cambridge, Mass., manufacturer of the Poly-Viso Cardiette for biophysical research, is another of the many users of "Mass. Gears." This sensitive instrument calls for the application of gears of extreme precision, a requirement which is inherent in "Mass. Gear" production.



"Mass. Gear" is ready to assist you with your gear problems. Address: Massachusetts Gear & Tool Co., Woburn, Mass.

Massachusetts Gear & Tool Co.

Woburn, Mass.

fight up to the present point has really helped production. Such a distraction, especially when it is of a nature to arouse the feelings of men to the point where they begin to take sides, cannot possibly help production. Efficiency will steadily depreciate throughout the department until the matter has been settled in one way or the other. The situation should be most carefully watched, if and as it continues to grow in intensity, with the idea in mind of trying to establish a "right" course of action.

If it can be clearly demonstrated that one of the two men is more liberal than the other, Al should try to make the men in general see it, beginning with the most sensible men in the department, as he has already started to do. But a temporizing course of action must not be followed very long. Al should gradually get a little tougher with the situation and with the men involved, until they fully understand that either who continues to make trouble will have to go.

If Al can discover, in the meantime, any really sensible man in the department who is a definite friend of either of the two principals, he might be able to prevail on him to go to his friend and try to talk some sense into him. Even a bullheaded man will sometimes listen to his friend when he will not listen to anyone else. Al should keep his original goal in mind, to save everything possible out of the situation, but once it is plainly evident that a greater loss is involved by being lenient than by getting tough, he should deal out discipline with an unflinching hand, and make it final.

John E. Hyler
Peoria, Ill.

•

LITTLE PITCHERS, BIG EARS

Tom, the worker, talks about his troubles at the shop while he is at home. The foreman hears of it through his son, a playmate of Tom's boy. What recourse has the foreman, without involving his son? Who is at fault? Possible remedies from our readers . . .

AT ONE TIME, it seemed that Ed was the one who needed commiseration, his weakness, which desrevs respect, being the possession of a heart often larger than his head, when brains were needed. Al, however, seems to be advertising that whatever his heart may be, his mind is of the pigmy type and his outlook that of the village pump. It would have done Al

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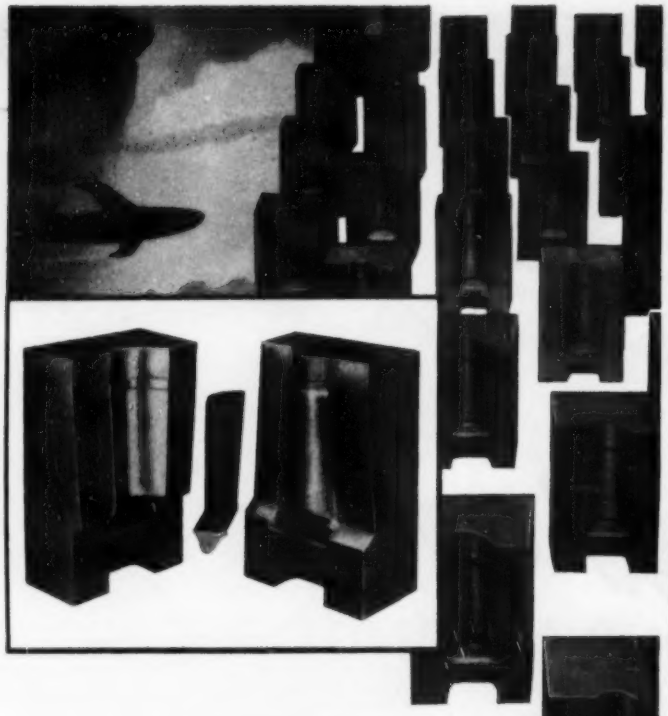
8" table travel . . . 25" x 9" table . . . automatic hydraulic table feed.



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good to have heard a little tale a schoolmaster told his pupils when the writer was a boy.

In a little village, one housewife used to fetch her groceries from the village store, her basket being carried by her big retriever dog, Jumbo. At the store, lived a noisy little terrier, Vic by name. Whenever Jumbo came into sight, Vic would start barking so furiously that one might have expected Jumbo to turn back or cower in fear. But Jumbo did nothing of the kind, he came and went, entirely ignoring Vic. The schoolmaster suggested to the boys that they should follow Jumbo's example and always act the big dog.

Years afterward, these boys had grown up and one of them in a works was engaged in a triangular conversation, in which one of the party, a somewhat petty type, tried to be offensive. This particular "boy" took no notice and was chided by another of the party for his indifference. They were standing near a window; on the other side of the street a dog was barking. Said this same youth to the one by whom he had been chided for his apparent lack of spirits: "That dog is barking at us. What are you going to do about it?"

"Do about it; why nothing, of course. Do you expect me to take notice of every cur that barks?"

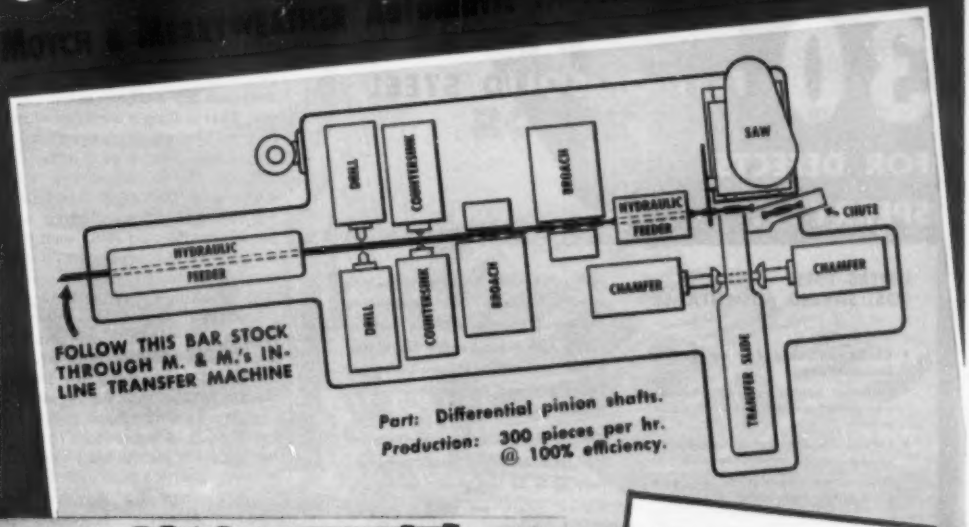
"No," said the chided one, "neither do I!"

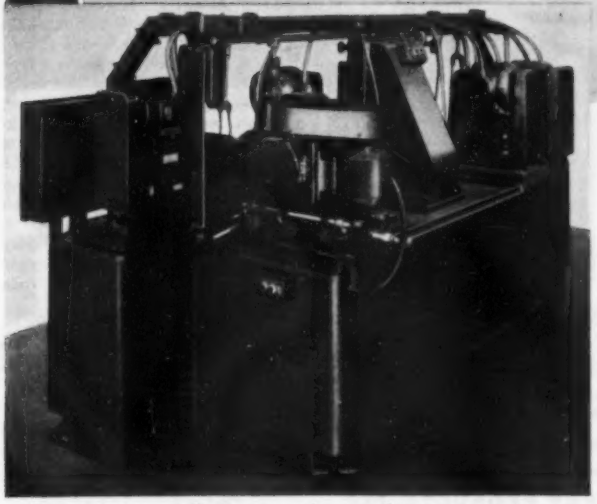
OK, Al, be a man, follow the example of the dog, Jumbo, and do not get upset by little things or you will soon be as petty yourself. You seem to need intellectual spectacles; then you may find the fearsome spectre is chained; or toothless, or otherwise harmless and your trouble just imaginary.

P. E. James
Lincoln, England

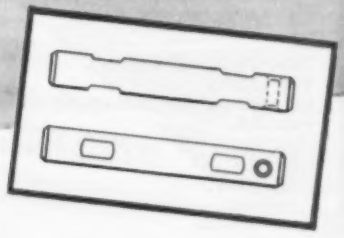
"Psst! Hey Sam, wake up! The boss is coming!"

Combine Operations





Save time and floor space by combining operations.



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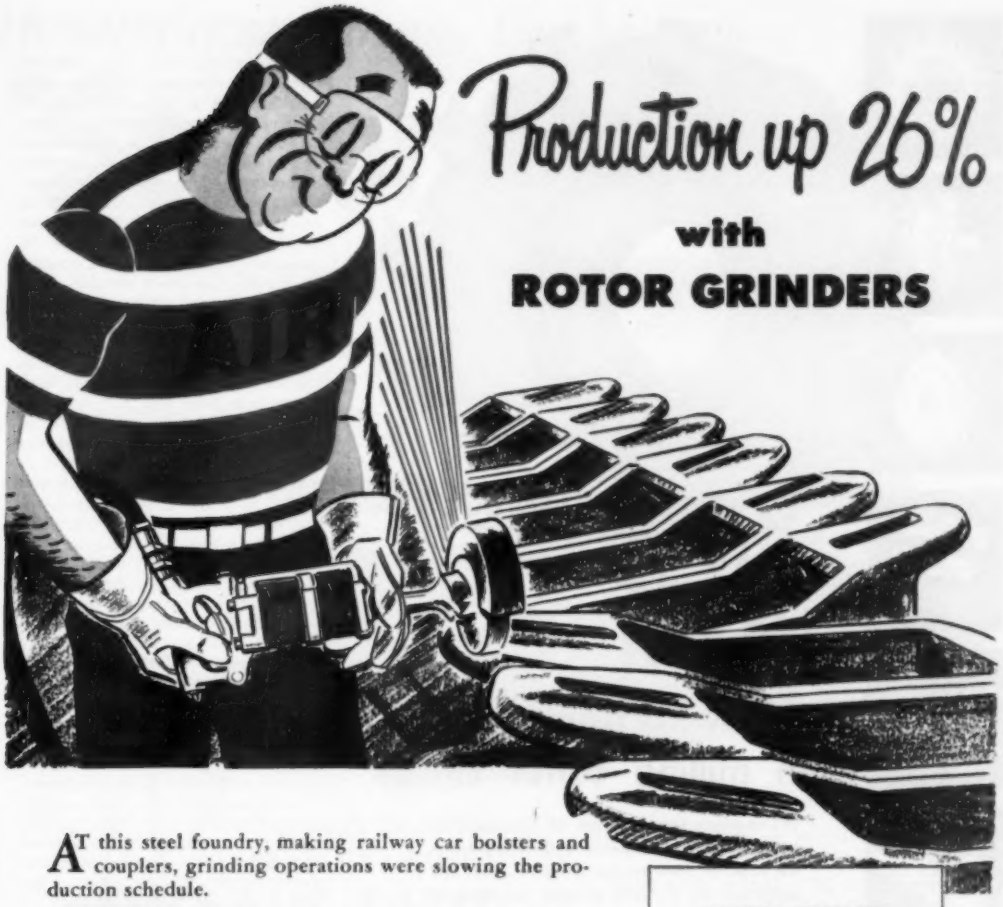
POWER OF SUGGESTION

THE IDEA of restraining supervisors from receiving awards for their ideas and suggestions undoubtedly is one that arose from complaints of workers in the past, that supervisors "stole" ideas of men working under them, and reported such ideas as their own. But it is patently so easy to set up a suggestion system in such manner as to make this impossible, that it should be easy to convince all workers it cannot happen. This is simply a matter of setting up the system so suggestions from individual workers never pass through the hands of any of their supervisors. The general idea of making supervisors ineligible for awards for ideas affecting their own departments sprang from the same general suspicion.

If workmen are encouraged to offer their suggestions through a system in which their immediate supervisors cannot know who made a suggestion, or what the nature of the suggestion may have been, there can be no sound reason in the world for barring a supervisor from making suggestions touching his own department, with a cash award in view.

Shall a man in a supervisory position be discouraged from making suggestions, when he is just as likely to run across a valuable idea (if not more so) than the average worker? Shall a methods man, whose mind runs more or less continually on methods, be discouraged from making suggestions in regard to methods? Shall a safety engineer who runs across something really valuable and new in his line of work be prevented from cashing in on it, while any or all men in no way connected with safety are encouraged to offer suggestions with a cash



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3100 to 21,000 R.P.M.

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4" grinder—8¾ lbs.
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HANDLES
Straight or Spade.

AIR O'TOOL

AIR ROTOR TOOL HIGH CYCLE

award in view? It simply does not make sense.

If a new idea on a more efficient method of reducing absenteeism, a new idea on a method of providing freer materials-handling access through the aisles of a department, or a new means for providing greater accuracy in a machining operation where accuracy is important, at no increase in cost, can be put into effect, and the profit sheet can be favorably affected by the change, what difference can it possibly make to the company whose idea it was or to what man the award for the idea was paid?

If a man is sinking in quicksand, and a supervisor comes running with a board to help him out, it is unlikely that he will tell him to go away, that he wants one of the other workers to bring the board. In that case, a board is a board, and he will grab it. All losses are financial quicksand, and the suggestion system is a board designed to point the way out of the quicksand and onto firm financial footing.

Of course, suggestions cannot be too carefully handled to make certain that all decisions and awards are strictly impersonal. One good method of doing this is to maintain a master file for all suggestions coming in, and to divorce the name of the man who made the suggestion from the suggestion itself during the process while it is being considered as touching its worth. Each suggestion, under this regime, will be given a number or a symbol. The number may be kept on a card in the master file, together with the name of the man who made the suggestion.

Thus, when a committee has made a decision in reference to suggestion

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at the
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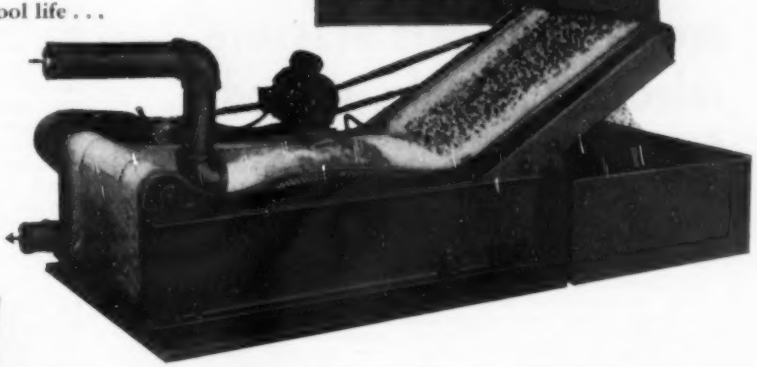

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See it Work at the Tool Show

If you can't get to the Tool Show, be sure to write for equipment bulletins giving complete information and specifications on Coolant Filtration and Handling equipment described above.

See Them Work at the Tool Show . . .

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*Chicago, March 17-21

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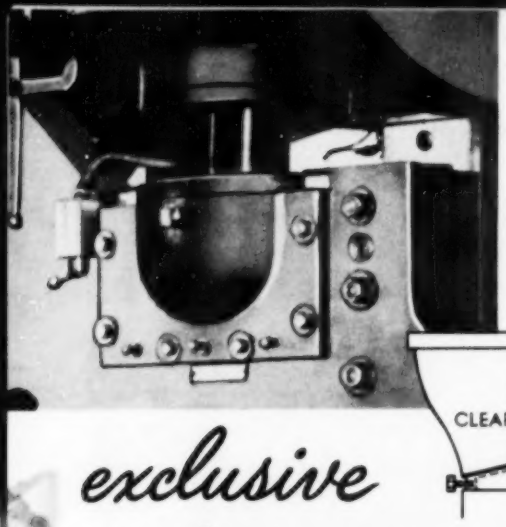

Detail showing how wedge movement permits ¼" additional downward ram travel.

exclusive

wedge-type ram pressure release . . . simple, rugged, fast-acting

A striking example of Columbia's advanced engineering is the wedge-type ram pressure release for quickly releasing ram pressure in event of bottoming of dies — another exclusive feature of Columbia Power Press Brakes.

A heavy steel wedge with the top angle complementing a similar angle on the base of the ram adjustment socket housing is moved back by turning a screw to gain up to ¼ inch additional downward ram movement. After the dies are released, the wedge is drawn back into operating position and securely locked by tightening two cap screws. The entire operation requires but a few minutes and requires only one tool—a wrench.

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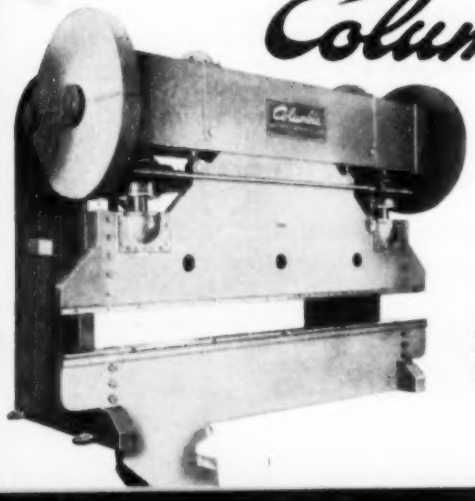
For bulletin and address of a nearby representative qualified to assist with your metal forming and shearing problems, address Columbia Machinery and Engineering Corporation, Hamilton, Ohio.

Columbia

POWER PRESS BRAKES *and* **STEEL SQUARING SHEARS**



120 to 1000 tons, for forming mild steel 3/16" to 1" thick, 6 to 20 feet long.

No. 20,119, for instance, it has made that decision without knowing who will be affected thereby. If suggestion No. 20,119 is then found, by referring to the master file, to have been submitted by a supervisor, he should have the net amount of the award. If a sweeper, newly hired, is found to have made the suggestion, he should have the net amount. If the awards are given quietly, it should be as quietly done for the one as for the other. If there is a good bulletin-board notice or other fanfare, it should be precisely the same in either case.

If the objection be advanced that a foreman made eligible for suggestion awards is likely to neglect his duties while dreaming up suggestions, it may be advanced with equal force that the sweeper is likely to lean on his broom somewhere and dream in like manner. Any way one looks at it, a man's position should have nothing to do with it. Topnotch ideas come from likely as well as from unlikely sources. A company should endeavor to remain in a position where it can receive them freely, regardless of their point of origin.

John E. Hyler
Peoria, Ill.

•

THE POLICY of barring awards to supervisors for ideas adopted for their own departments is wrong. Although ideas are considered in the line of duty, the foreman should get recognition in some tangible way. It does not have to be cash or bonds, it could be a plaque or merchandise. Some firms give their foremen a gold lapel button with the number of adopted ideas inserted in it. With each new

"Well, we have the dies, all we need now is the plant, the men and the know-how!"

idea a new number is inserted.

Let's not kid ourselves we all like something tangible to give us that feeling of importance. I don't go for that "methods by methods men" or "safety ideas from safety men." The man who sweeps the floor may come up with a winner, and it is right he should do so. Regardless of the source, we must recognize merit and treat it well. Every man has the right to be enterprising. Brains are not confined to top strata.

Every employee who turns in an idea should receive a letter of thanks whether it is adopted or not. This will let the employee know his efforts are appreciated and he will be encouraged to try again. The LSMFT idea of repetition will go a long way in making the employee feel a part of it, see it, contribute to it, and desire it.

The foreman whose department turns in the most ideas should also be rewarded in some tangible form at the end of the year. The big idea is to make the suggestion plan work for that "together-minded" spirit for cheaper and quicker ways of doing the job.

A. E. Salmons
Philadelphia, Pa.

•

NOT ENOUGH CHIEFS

THIS QUESTION of whether to rotate men from job to job is one which must be answered according to the conditions which exist in a particular shop or plant.

We must consider such factors as type of shop, type of product, urgency of delivery and whether the shop is unionized.

In a small jobbing or general machine shop, it might prove advantageous to rotate the men and thus

"Hey, Joe! Someone to see you and by the way, you owe me five bucks on that bet we made last March 15 . . ."

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PRECISION LATHES

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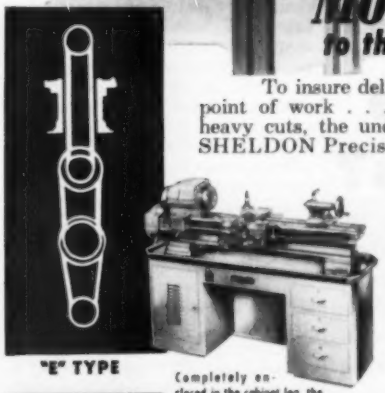
to the point of work

To insure delivery of full power at the point of work . . . to prevent slippage on heavy cuts, the underneath motor drives of SHELDON Precision Lathes have double V-Belts driving the spindle. Tandem V-Belts, each of which engages the spindle around a full 50% of its circumference.

You will note a feature of SHELDON underneath motor drives not common to other moderate priced lathes is the extra, underneath counter shaft that permits driving thru a *standard* 1-piece lathe bed. There is no cutting away of the bed for belt clearance, nor use of "spliced" beds, in SHELDON Precision Lathes.



"E" TYPE

Completely enclosed in the cabinet leg, the the SHELDON Type "E" Underneath Motor Drive has matching 4-step, V-Belt sheaves which provide 4 speeds (8 spindle speeds). All belts are provided with individual means for permanent adjustment of tension.

"U" TYPE

With a SHELDON Type "U" Underneath Motor Drive, all speed changes are instant—are made by clutches operated by levers that are conveniently located outside the enclosed cabinet leg. 4-speeds (8 spindle speeds) and individual belt tensioning means are provided.

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pointing problems?

Torrington Swaging Machines produce pointed ends on both solid and tubular work to close tolerances. The swager, delivering 4000 hammer blows a minute, works rapidly and gives the metal toughness and resiliency. Swaging is economical, too, for there is no stock waste.

"The Torrington Swaging Machine" tells the story on the art of swaging, and describes the complete line of Torrington machines. This informative booklet is yours for the asking.

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keep them in shape to handle any job which might come into the shop and also avoid the possibility of a tieup because of absence of any one man.

On the other hand, in a larger shop doing production work, the operations may be highly specialized. To get best production results, it may take too much time to break in a new man to such a degree that he can make up the loss of production caused by taking an experienced man away from the job he knows best how to do, especially if he is only to do the job temporarily. Of course, it is a good idea to have some advanced apprentices rotate around from job to job to be ready to take over a specific job should you lose a man from illness or death or for any reason whatsoever.

Considering conditions as they are today, in tool and machine building shops, where the equipment is highly refined and specialized, it would seem foolish to take, for instance, a good jig-borer or milling-machine man and set him to working at a lathe or drillpress—the chances are that he has already had experience with these tools and would not feel any curiosity about getting a job at them—nor would it seem wise to take time out from a schedule to break in a drillpress man on a critical milling job—bearing in mind that it takes a bit of time to train a man to get real production from a milling machine especially on tool work.

Further, different rates of pay go with different jobs—the drillpress operator doesn't necessarily get the same rate as the jig-borer operator. Can we ask the expert grinder hand to accept the rate of say, a lathe operator; even for a short time? Would it pay the company to pay a

". . . And to think my mother used to tell me, 'You'll never get a job if you don't keep yourself clean'!"

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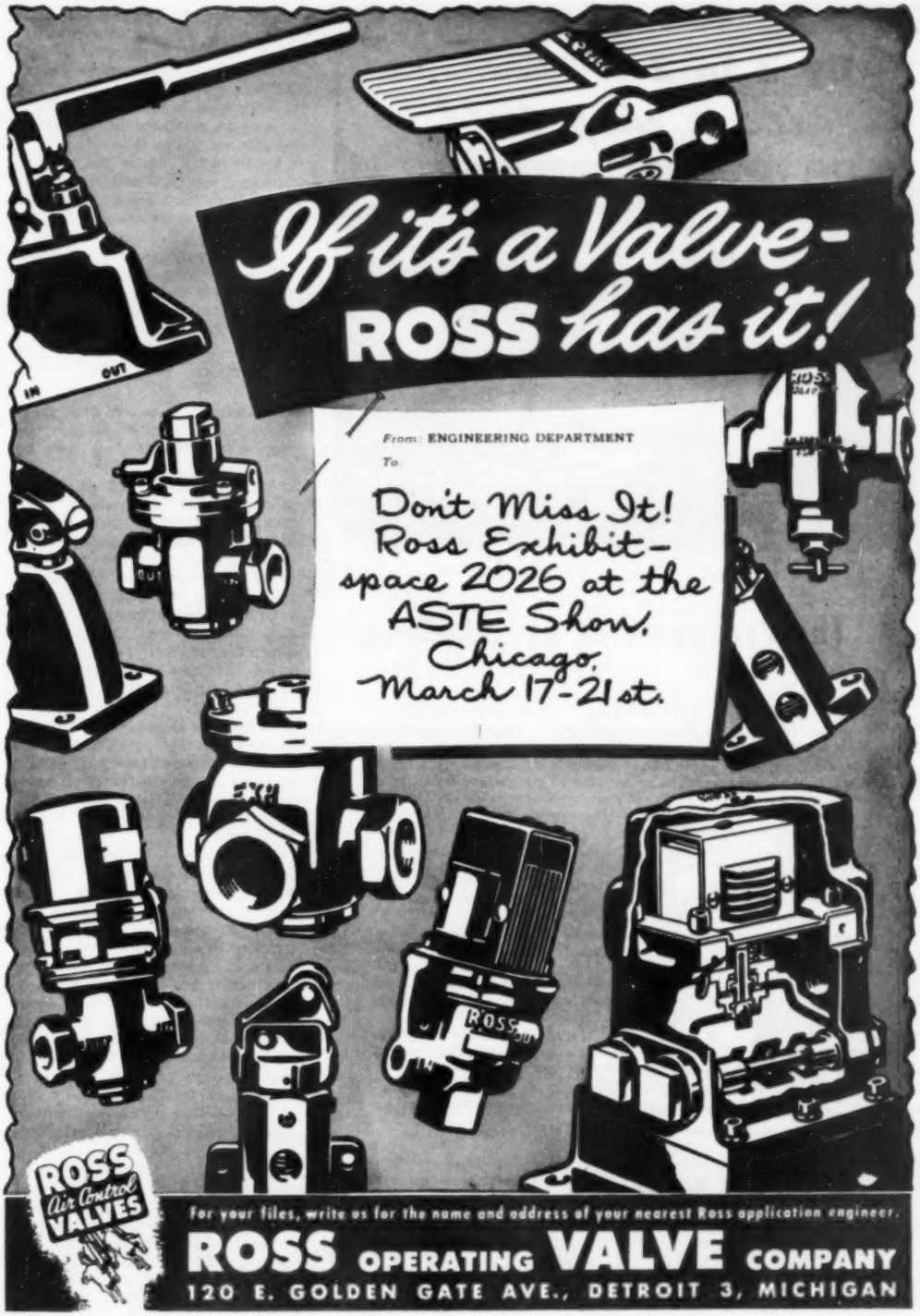
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By 3 to 2
it's a shop tool!

The Profilometer at National

At the National Cash Register Company plant in Dayton, Ohio, Profilometers used as shop tools outnumber those in inspection three to two.

For example, the Profilometer shown is on *actual* production work in a machining department. Here, the surface finish of a bearing in a side frame of a cash register is being checked. Reaming specifications call for the bearing surface to have a rating of 20 microinches or less.

Other Profilometers are used as shop tools in two parts-machining departments. Still others are used in tool inspection and in investigation-inspection. The latter section—with the help of the Profilometer—determines if the engineering specifications for surface finish are being met.

Extreme accuracy has always been stressed in the more than 180,000 different parts that go to make up National Cash Register accounting machines and adding machines. Because of that policy, the National Cash Register Company was one of the original purchasers of a Profilometer. That investment has paid off many times.

If accuracy in surface roughness measurement is important in your plant, the Profilometer can give it to you.

To learn how the Profilometer can help cut costs in your production, write today for these free bulletins.

Profilometer is a registered trade name.

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higher rate, temporarily for drill-press work, done by an expert jig-borer operator? Then, what of seniority rulings in the union shops? No, let's not upset the apple cart by moving men around — it's tough enough to get them to be efficient on any one job as it is.

Furthermore, unless the rotation plan is fully explained and understood, it might influence morale in a negative way by causing the men to wonder "what next" and why.

In this day of specialization, if you have a man trained and qualified to do one job well, it might be best to keep him satisfied to continue to do that one job well.

Henry George
Dayton, Ohio

•

THERE ARE big shops and little shops where the "rotation of jobs idea" has been tried. Results have been inconclusive.

At one shop of 800 employees, labor turnover was reduced by a small percentage, so they thought of it in a favorable light.

The reason described was that there were more than 1000 operations done in that shop and that by rotation, different men of different dispositions were finding work which they liked. In fact, some men, when the time came to change, asked to be left where they were then working.

During the discussion, Ed says he has to meet schedules. Unless an apprentice has been especially taught in some special operation on some set of operations, what business has a foreman to put any boy on limited-time work?

In every shop there are jobs, some of them odd ones, which may be liked by several of the men.

Several years ago, it was the procedure in one plant to keep an apprentice on one line of work as long as he would stand for it, no matter whether he was contented or not. In this plant, there were usually about 14 apprentices among the 500 or more employees. Of these, eleven were dissatisfied because they were not being advanced to other work and other machines to learn the trade. It will be found that this attitude is quite prevalent among boys with some ambition.

One boy of the apprentice crowd was appointed to approach the general foreman and ask for changes and received little consideration.

The foreman said something like this: "You boys don't know how well off you are. You have cost the company much money. We mean

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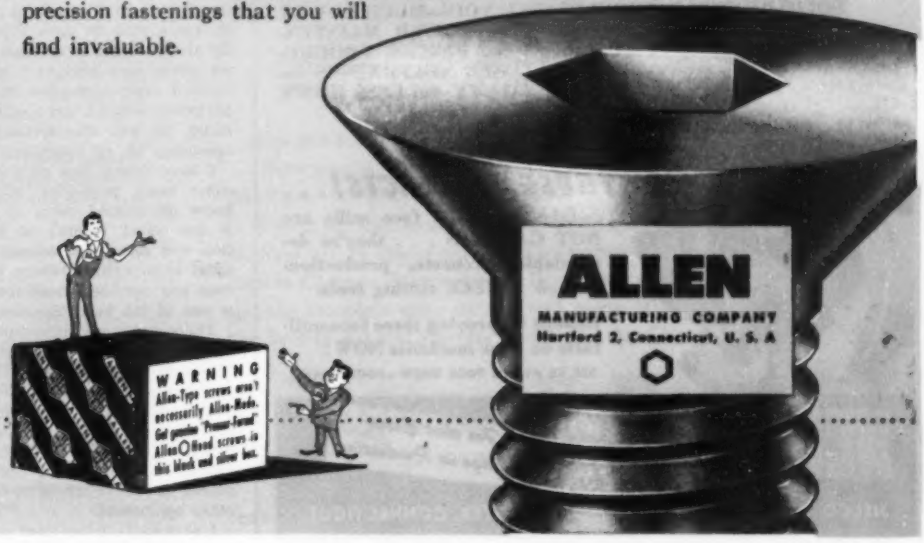
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"This NELCO solid-brazed, carbide tipped mill is the best tool we've got. We get the most for our money — it's solid, rugged and dependable . . . gives better finishes, higher table feeds and turns out more work between grinds. Boy! It's a Honey!"

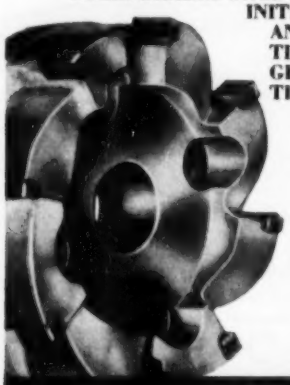
HERE'S WHY...

2 or 3 solid-brazed face mills cost *less* than 1 inserted blade type! The same initial investment provides 1 or 2 *spare* cutters which can be used while grinding the original.

There's less chance of damaging rugged, one-piece solid-brazed type cutters. No moving parts to keep aligned! . . . No loose parts to shatter, to accidentally injure workers.

A SOLID tool *has to work to closer tolerance!* It's a fact!

Solid-brazed cutters can be repaired *quickly* when damaged — No costly machined body to be re-worked or replaced. 1 blade for an inserted type cutter costs as much as 3 to 5 replaceable solid carbide cutter tips. The solid-type face mill has up to twice as much usable carbide. THEREFORE — SOLID-BRAZED FACE MILLS GIVE YOU—MUCH LOWER INITIAL COST — LOWER MAINTENANCE COST — FASTER PRODUCTION — CLOSER TOLERANCES — GREATER SAFETY and LESS DOWN TIME!



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to run our business as we see fit and we won't have interference from a lot of amateurs." The result was that within two weeks, four boys had quit, and, later, three more left and went to other shops where the treatment was better. In cases like this, the foreman and his company suffer in the long run.

Today, all men are treated decently, and there are few cases where apprentices are bullied in the shop.

Yes, it is a good course of action to have rotation, for, when a man is out, there is another who can take his place without the necessity of breaking-in a raw recruit.

F. H. Stebbins
Worcester, N. Y.

•

THERE WAS a time when an employee was hired for one particular job or operation, with very little chance to learn anything else. When someone was absent, one or two men would take over. Usually there were only one or two employees who knew all the operations. If they were absent at the same time, the machine or operation might be down for days.

With the organization of unions, strict observance of seniority, and more and longer vacations, we soon found ourselves with all kinds of bottlenecks. We found ourselves with two or more employees on vacation at the same time. Often we would have absentees along with vacationists.

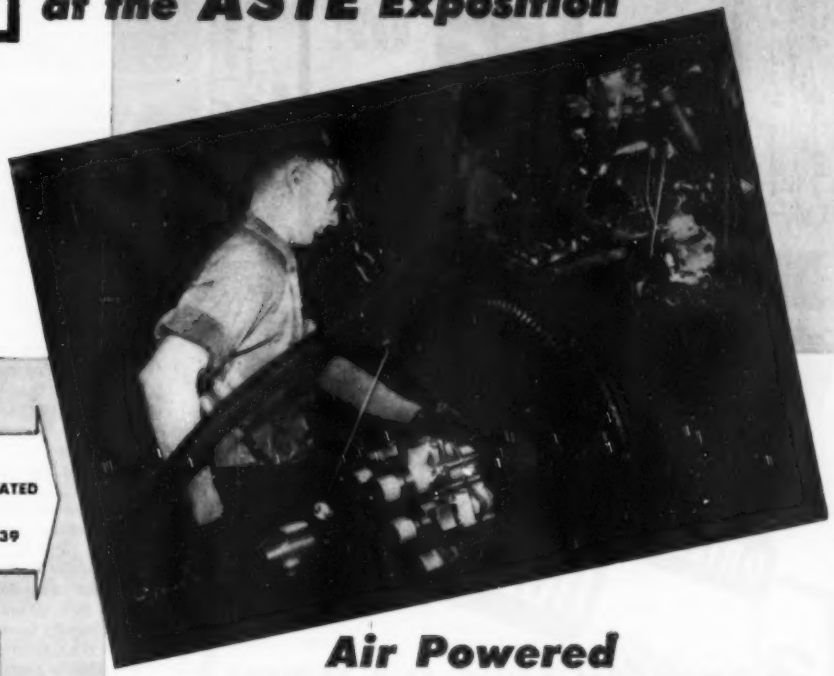
About this time, we found we would have to do a job of training. For several months we carried an extra man in each department. By the use of the rotation system, we made sure that each employee learned every operation in the department. When a new employee was hired, he was also trained in the operation of all machines.

I have found that employees became more proficient when they knew all related parts of the job. A few short months of job rotation will place the average department in a position where they can man any machine at all times. This is one of the best remedies.

There are many opportunities the foreman should take advantage of. When all machines are in operation and one goes down for repairs or other maintenance work, move the operator over with another man. When the machine goes down for any reason, make sure the operator is placed elsewhere where he can learn other operations.

I personally found that some em-

IR presents... at the ASTE Exposition



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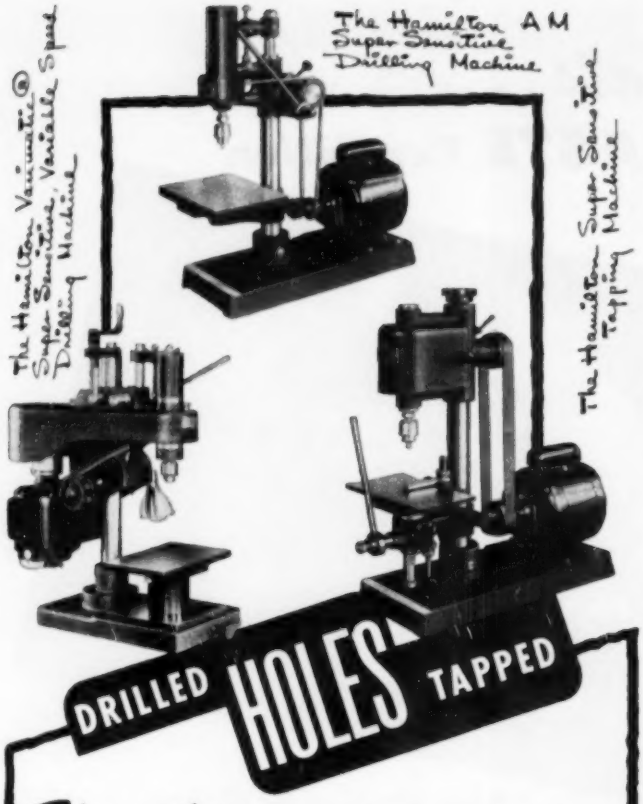

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ployees who did only a fair job on a simple operation were outstanding on a more difficult or skillful one. A man can lose all his possessions, but what he puts into his head cannot be taken away.

A. E. Salmons
Philadelphia, Pa.

•

TWO MASTERS

"No man can serve two masters" is an adage as old as the pyramids, and has been proved many times. However, many times men have been trying, through their organizations, to obtain sufficient wages with fewer working hours, to be in a better position to support his family.

With this in mind, it hardly seems to be necessary for any man to attempt to do double duty, but, if he does, it is safe to assume that there is a reason.

It may be hard luck, illness in his family or there may be other demands on him that make it necessary for him to get extra money. A man of this type is certainly entitled to consideration.

If Ed has the qualities ordinarily required of a foreman, he would have called upon Smedley during his illness and discussed the situation. At the same time, Ed would, of necessity, be quite personal with him. If the latter was financially embarrassed, this phase of his circumstances should have been talked over for the consideration of both.

Smedley is not the first man who has tried to hold down two jobs at the same time and failed because his health would not endure such a siege.

When men worked ten hours a day, thousands of them have been known to go home, have their suppers and then work in their gardens for two or three hours, and some have worked late by moonlight but many of them have been compelled to give it up, for, after working the regular hours at their shops, they hadn't the stamina for such long hours.

Many times this might be applied to men who worked many hours of overtime on their regular jobs.

To cite a case or two of similar kind, Pat K. was a big strapping Irishman who weighed 220 lb, full of energy. He actually turned out about 8% more work than the average man, doing like work, in the shop.

He could operate any machine tool in the place, and, being hard and brawny, he usually worked on big stuff. At the time, he was finishing

That goes for machine tools, too!

Even when machining at high speeds and feeds, Antisep All-Purpose Base solutions remove heat so swiftly that smoke has no chance to get started. Parts come off cool. Cutting tools last longer. Operators are better satisfied.

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A New England tool company reports that switching to Antisep gave them the top-quality finish demanded in their production of Diesel connecting rod nuts ... and much cleaner work. SAE 4140 steel is the metal machined on a Warner & Swasey No. 5. Antisep Base, diluted with water, cost 22c per gallon and replaced former coolant costing over 70c per gallon.

COOLANT COSTS CUT 68%!

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your alloy steel supplies!

You have doubtless heard about "bar-stretchers." Have you ever seen one? Wheelock, Lovejoy has several – any one of which can help you stretch your alloy steel supply so that you can keep up your production schedules during this period of unavoidable shortages. Having been in the steel business for over 100 years, our staff of metallurgists is in a unique position to help solve your difficulties. Our "bar-stretchers" include suggestions for substitute grades – alternate methods of manufacture – varying your present methods of treatment – and many more!

A letter or phone call to your nearest Wheelock, Lovejoy warehouse will bring an experienced man to help you stretch your alloy steel supply.

And he will be delighted to be of service! *SCRAP is worth money, and every pound turned in means more steel for you – so get in the SCRAP!*

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a 7-ft spider where the cuts were long and took considerable time.

As Pat knew he was doing more work than the other men, he asked for a raise. He was refused, and he didn't like it.

A friend told Pat of an opportunity to work part time so he applied for the job and he got it. He worked from 7 to 11 p.m.

On his regular job and because he worked on the long cuts he had time on his hands, and, after working for a few weeks at both jobs, he would occasionally nod his head and would doze off. Then someone, working near Pat, would wake him up if the foreman or the brass approached, so he was not caught.

One day he was having a nap when the general manager was showing a visitor through the plant and Pat was seen to be asleep. Then there was fireworks, and the foreman was called up on the carpet to explain about Pat's actions.

Pat was laid off for two weeks, but when he returned, the starch had left him and his production began to fall off to a noticeable extent.

One day, from his drowsiness, he stumbled over some of the material which had been left for him to finish and fell on the concrete floor.

Result: a broken arm, hospital expenses, and three weeks of time lost. So, again we say, "No man can serve two masters."

F. H. Stebbins,
Worcester, N. Y.

•

AFTER THE BALL

FOR STAFF MEMBERS who are sitting on a chair all day long, exercise is a necessity. They need a long walk or a game of baseball every day. That will keep them physically and mentally fit for their work. Working men, however, need mental, not physical exercise.

When practicing or participating in sports, accidents are very common. This is a drawback to sports in our times of high production. Athletes' muscles sometimes become so large, also, that they draw too much nourishment from the brain so the man cannot think very clearly. What the workingman needs is mental exercise of some kind to keep him alert.

Why not organize teams in mathematics? That's the kind of exercise workingmen in the shop might exploit usefully, and it might promote ideas to increase production. To hire men for athletic prowess rather than working ability or skill is to me the height of folly.

Everybody must attend strictly to

"Tycol Afton keeps cutting edges cool... lengthens tool life between grinds"

Right! Tycol Afton Cutting Oil steps up tool performance . . . allows closer tolerances and finer finishes.

It makes fast, free cuts possible—reduces spoilage and the need for frequent regrinding.

Tycol Afton is a "dual purpose" oil, used for both cutting *AND* machine lubrication. Several grades are available for use on any specific machine tool.

For complete information, call or wire your nearest Tide Water Associated office today.

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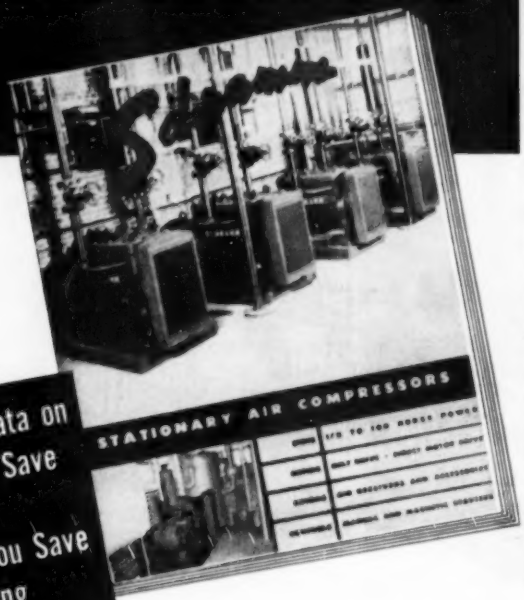

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business during working hours. Spending time with others yapping about baseball or some other sport activity ought to be prevented in some way.

Ed should tell McDoud in a nice way that it is better to hold off discussing baseball results until after working hours, then he can tell the whole team about it at the same time. In some countries in Europe, there is a lot of betting going on about the latest sporting results, which is very detrimental to working efficiency.

A. E. Fristedt
Stockholm, Sweden

NEW BOOKS

ARC WELDING. *By Charles H. Zielke. Published by Bruce Publishing Co., Milwaukee 1, Wis. 63 pages. 8½x10¾. Price $0.80.*

Written by a welding instructor, this book is well suited as a training manual for teaching the fundamentals of welding. The 40 lessons are brief and practical. Each outlines a specific task to be performed, and gives a group of questions to be answered.

•

METAL FINISHING GUIDEBOOK DIRECTORY (20TH EDITION)—*Published by Finishing Publications, Inc., 11 West 42nd St., New York 18, N. Y. 568 pages. Price $2.50.*

Each year brings a new edition of this guidebook, and each edition proves more valuable than its predecessor. This year's is no exception.

The unending flow of new materials and new processes in the field of metallic surface treatment make it impossible for a standard textbook to be completely up to date. Yet it is the new developments that are of the greatest importance to practical platers. The new edition of the Guidebook contains detailed information on the how and why of virtually all the new procedures. At the same time, the conventional processes are not neglected.

Sections include finishing plant engineering, mechanical and chemical surface preparation, plating solutions and operating data, special plating procedures, special surface treatments, control, analysis and testing, tables and data sheets, and a directory of suppliers and manufacturers.

a critical **ORDNANCE** job solved with . . .

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die set
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Millions of small ordnance fuse component springs stamped exactly right. Tolerance between punches and dies is maintained thru 18 stations at .0005" . . . only the top quality of Producto Die Sets makes such accuracy possible.

OPERATIONS: Piercing, forming, blanking.
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the **PRODUCTO MACHINE COMPANY**

2PD88

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It will pay you to review

Production Increased 89.7%

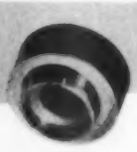
Grade: MX
Cold drawn size: 5/8" Rd.
Part Name: Camera coil case for flash gun
Machine: New Britain
Operations: Spot and form, drill 27/64", drill 27/64", ream and shave, thread, cut-off
Cutting Media: MS Steel and Allube Nu-Sol No. 2

Comparative production:

Grade	SFM	Seconds per part	Parts per Hour	Production Increase
B-1113	110 Turn 35 thread	11.3	319	.....
MX	230 Turn 70 thread	6.0	605	89.7%

Production could have been improved except threading operation governed production.
(Material cold drawn by Bliss & Laughlin, Inc.)

Production Increased 41%



Grade: MX
Cold drawn size: 1/2" diameter
Part Name: Hub
Machine: Brown & Sharpe No. OG
Operations: Center drill, drill, ream, front slide form, back slides cut-off

Comparative Production:

Grade	SFM	Seconds per part	Parts per hour	Production increase	Tool life hours
B-1113	225	12	300	.....	Same for both
MX	298	8.5	423	41%	

(Material cold drawn by Bliss & Laughlin, Inc.)

Production Increased 33.5%

Grade: MX
Cold drawn size: 1 1/8" Hexagon
Part Name: Bearing stud bolt
Machine: Model 61, 1 3/8" New Britain, 6-spindle
Operations: Rough and breakdown knee turner, finish knee turning, face off, finish form, hollow mill, thread, breakdown cut-off, cutting off
Cutting Media: Shell Fenella # 921 (Sulphurized)

Comparative Production:

Grade	SFM	Seconds per part	Parts per hour	Production Increase	Tool life Parts	Tool life Increase
B-1113	200	20	179	.....	716	.....
MX	250	15	239	33.5%	1912	167%

All MX parts have superior finish. Tools ground only half as often with MX
(Material cold drawn by Bliss & Laughlin, Inc.)

Production Increased 27%

Grade: MX
Cold drawn size: 1 3/8" Rd.
Part Name: Pulley
Machine: Brown & Sharpe, G-2
Operations: Center drill, recess and drill, tap 5/16", thread, form, face and cut-off. (Feeds increased with MX)
Cutting Media: Socony Vacuum General Purpose oil, plus 3% sulphurized. Filtered and cooled to 50°.

Comparative production:

Grade	SFM	Seconds per part	Parts per hour	Production Increase
B-1113	245	35	103	.....
MX	312	27.5	131	27%

Tool life with MX was equal or superior to B-1113. High quality finish maintained.
(Material cold drawn by Bliss & Laughlin, Inc.)

steel "specs" set up years ago ...now that costs can be cut with MX

today's freer-cutting screw stock!

THE old ways are not always the best ways. Now that U·S·S Free-Machining MX has been developed, the performance of those older specifications for screw machine stock, that you've continued to follow without question on repeat orders, should be carefully re-examined.

For with this new freer-cutting MX screw stock, your screw machine parts, no matter how intricate, can be turned out faster and with less tool wear than when produced with ordinary Bessemer screw stock.

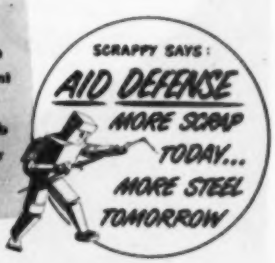
These are facts. In hundreds of shops that have used MX in producing millions of parts of many different kinds, the story is always the same. MX has shown that it will boost hourly output, lengthen the interval between tool changes, will produce more accurate parts and improve part finish. In every instance where MX has been given a thorough trial, cost savings have been recorded.

These cost savings with MX have run as high as 42%—usually the figure runs around 10 to 15%. We feel safe in saying that MX will cut the cost of *any* part you now machine from ordinary Bessemer screw stock—even though MX costs a fraction of a cent more per pound.

Switch to MX. Give it a thorough trial and watch your production go up and your costs go down.

U·S·S Free-Machining MX is being produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier as "MX" or under his own identifying trade name. In hot-rolled form MX is available direct through our nearest district sales office.

NOW, when production is more important than ever — speed up the job and do it better with MX



USS

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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

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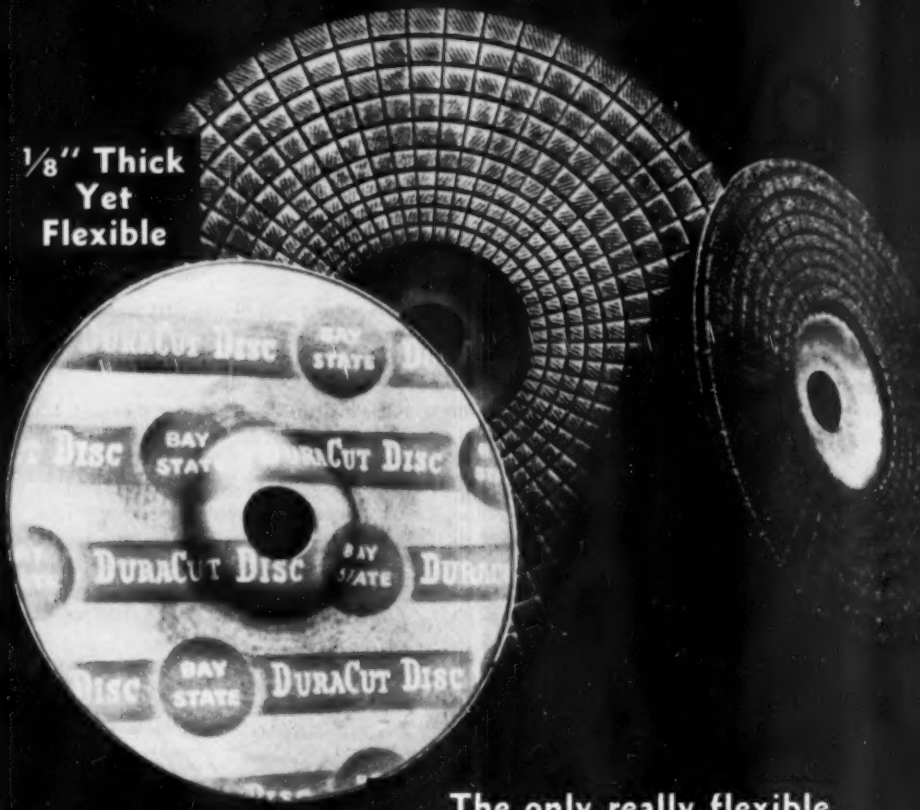

The only really flexible
grinding wheel ever offered

for blending welds the *Better* way

better because - They are More Durable

DuraCut's life expectancy is 10 to 25 times that of ordinary coated abrasive discs, meaning less down-time for disc-changing — more productive time on-the-job.

better because - They are Faster Cutting

DuraCut's unique waffle pattern with multiple layers of abrasive grain allows sharp, instantaneous cutting throughout the life of the wheel. Whether it's light snagging, smoothing or blending, there's a wide range of specifications to assure obtaining a fast-cutting, long-lived wheel for your job.

better because - They are Built Stronger

Every component part, from bond to backing, is designed and treated so as to lend added strength and flexibility to the finished product.

TYPICAL APPLICATIONS:

Finishing light welds on sheet metal jobs. Automotive, truck, railroad car or locomotive and aircraft body work. Blending welds on sinks, refrigerators, stoves, metal cabinets. Rust and scale removal.

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Puts work 'ON THE SPOT' Quickly... Accurately... at Lowest Cost!

SPEEDI-SPACER saves the cost of . . . and waiting for . . . jigs, fixtures, gauges, dies and templates. It also eliminates storage, obsolescence and maintenance on these costly production accessories. Best of all, SPEEDI-SPACER costs far less than comparable units. With it, any good upright or radial drill or vertical milling machine becomes an accurate jig boring tool; highly skilled labor is unnecessary.

Easily transferred from machine to machine, the SPEEDI-SPACER can be set-up in a fraction of the time required for setting a jig borer or boring mill. Nine longitudinal and nine transverse stop screws provide precise positioning, maintained by positive locks.

Longitudinal travel is 15"; transverse, 10"; with nine stops in each direction. Overall dimensions are 28" by 22". Mounting T-slots are provided. Find out how much the SPEEDI-SPACER can save in your shop.

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SABOTAGE is a greater potential danger for most plants than bombing. Have you taken any precautions to guard against it?

MORALE isn't built in a crisis; it's built beforehand. The crisis only tests it.

THERE'S an old saying that "If you want to be big, you've got to look big." Nobody likes a fourflusher or a fop, but everybody has been trained from childhood to expect a leader to look like one. Company policy can't earn respect on the major things either, if it is small on the minor things. Don't make your company look small.

How to install and operate a statistical quality-control program

Non plant managers may bring to their processes and products all the advantages of manufacture under statistical quality control, without special mathematical background or the assistance of statisticians. Using the language of the plant man, and minimizing technical terms, this book covers both the statistical methods required, and the practical steps of applying them to factory processes. It is up-to-date, comprehensive, based on wide industrial experience—a practical manual for the man responsible for improving production through this modern technique.

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by JOHN D. HEIDE

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SELF-EXPLAINING FEATURES TELL:

HOW TO construct curves showing the variation in a factory process

HOW TO design and construct control charts

HOW TO use control charts for maximum production efficiency

HOW TO sell workers on the idea of quality control

HOW TO keep the control operation to a minimum of time and expense

With simple, graphic illustrations, the first five chapters explain basic statistical theory—then use actual production problems to apply the theory in constructing control charts. Following chapters tell how to introduce and install the system, cover the technical problems of sampling and measurement, and offer practical program aids. Complete information is given on a simple method of rating product quality objectively, and determining the reliability of test results. Step-by-step, the busy plant man finds: 1) how to install a system of quality control in the factory; 2) how to administer an established system—methods that can be put to work in the shortest possible time.

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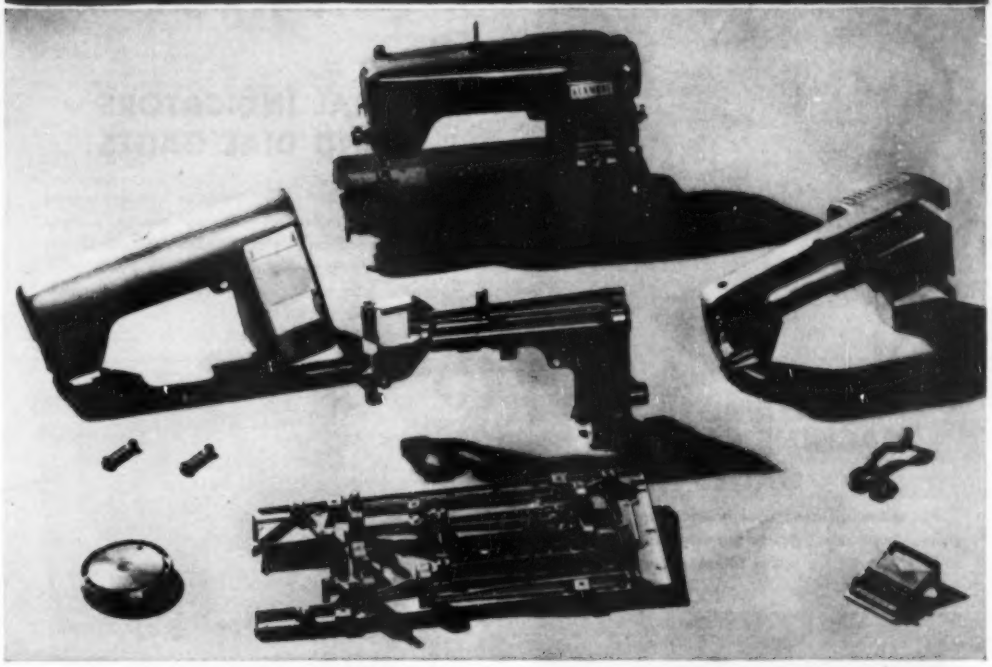

This new, modern sewing machine, manufactured by the New Process Gear Corp., Syracuse, N. Y., for Sears Roebuck & Co., represents an entirely new concept of the production of a sewing machine. Designed to permit "automobile assembly" techniques, this machine utilizes all the advantages of die castings.

In solving the problems in producing the component parts shown, Precision Castings Co. demonstrated these abilities:

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Save Time- Prevent Waste- with

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There's a Federal Dial Indicator for every gaging requirement — over 80 different models, ranges, sizes, graduations, styles. Also Dial Indicator Gages in regular and special designs — for all dimension-control jobs: snap, hole, thickness, caliper, comparator, etc.

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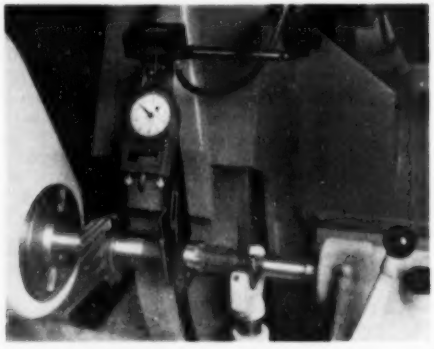
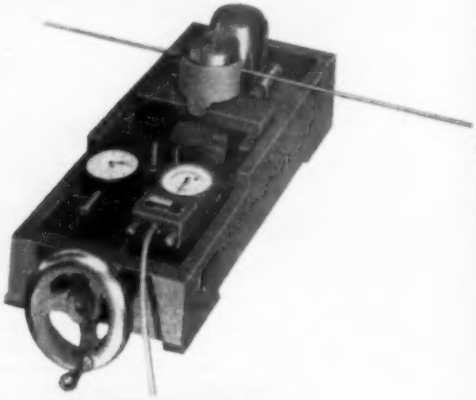
For automatic control of grinders and other production machines — govern the machine automatically — keep production within tolerances at all times.





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- Greatest measuring range of all — .003" with 2500 to 1 magnification.
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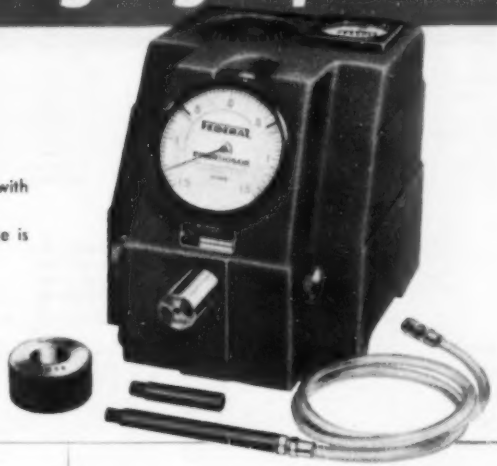
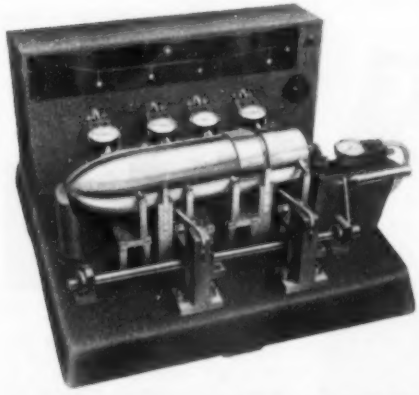
- Easy to set.





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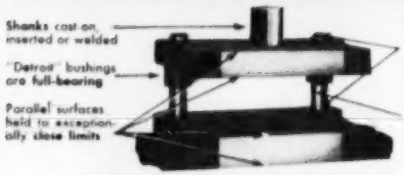
When you specify "Detroit" die sets, you are assured micro-metric precision that means 1) Lower costs in mounting die in die set and 2) Longer, trouble-free production runs. Factory-built die sets give you what you pay for—parallelism, squareness and finish.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IN MINUTES!

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Many difficult machining operations greatly simplified — sometimes eliminated — with Atlantic Contour Saw. Tough, sharp, milled teeth of Atlantic Contour Saw precisioneered for a long life of complex cutting to gage tolerances!

UNIFORM SET SIDE TO SIDE | **UNIFORM SHAPE IN EVERY TOOTH** | **UNIFORM WIDTH BACK TO TOOTH**

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AND WITH ATLANTIC YOU GET THE BENEFITS OF COMPLETE SPECIALIZATION OF SKILLS AND EQUIPMENT — Atlantic Devotes Its Entire Research, Production And Sales Engineering Facilities Exclusively To The Manufacture Of Band Saws And Only Band Saws.

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FILING with a NUCUT is like using two files in one. With each and every stroke, the coarse teeth slice off metal fast, true. At the same time the fine teeth finish the surface *smooth*. No skidding or waste motion, no clogging that requires frequent cleaning, no scratches to remove. In short—better, faster, easier filing.

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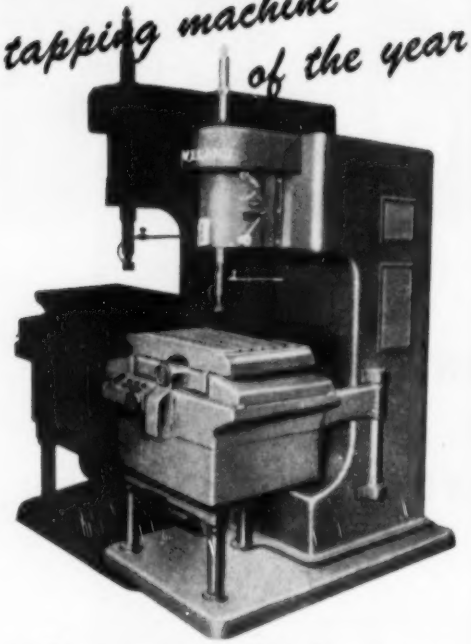
CLEVELAND tapping machines — lead screw

tapping machine of the year



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Moving freely in three dimensions, the compound table of the New Cleveland Type ER Tapper is another triumph of Cleveland engineering. Moves freely on ball bearing race-ways . . . 40" lateral travel . . . 24" travel front to back . . . compound a 24" bolt circle . . . 18" vertical travel is by motor drive . . . solenoid lock up of table.

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Fidelity of thread from the first thread to the last thread . . . ease of operation . . . all controls at finger tips . . . precision depth control . . . hardened and precision ground lead screw . . . heat treated alloy spindles . . . speeds quickly changed . . . rigid construction . . . added tap or die life.

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A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC.
CANTON 6, OHIO

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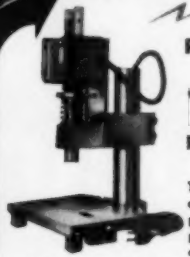

PRODUCES UP TO 10,000 PIECES PER HR.

This versatile low cost electric impact hammer produces up to 10,000 pieces per hour using automatic switching — as high as 5,000 pieces per hour with hand or foot switching. Ideal for steel stamping, inspection or identification marks on small defense parts.

ELECTROPUNCH is portable — plugs into any 115 V A. C. outlet. Lightest model (illustrated) sells for only $90.75.

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The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
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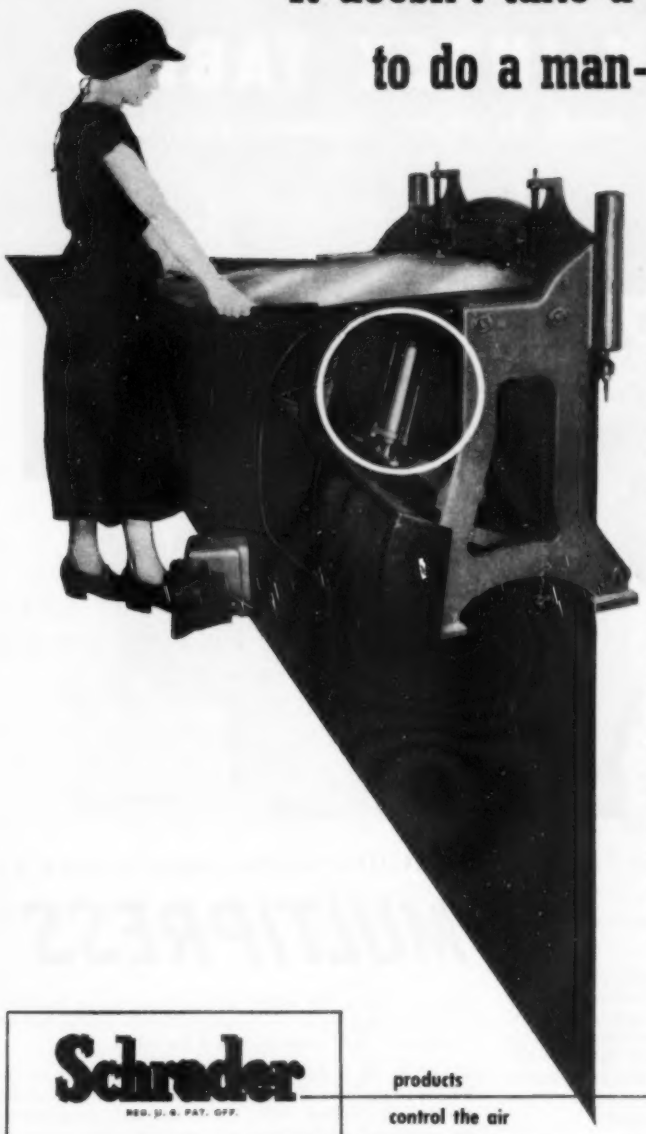
It doesn't take a heavyweight to do a man-sized job



Before these shears were shifted to air operation the entire weight of a man was required on the foot treadle to cut the sheet metal.

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This is just one example of how air cylinders can speed up production and reduce fatigue . . . one of many hundred applications of Schrader cylinders and valves. You can undoubtedly find many places in your shop where manual lifting, lowering, pushing or pulling is slowing up production.

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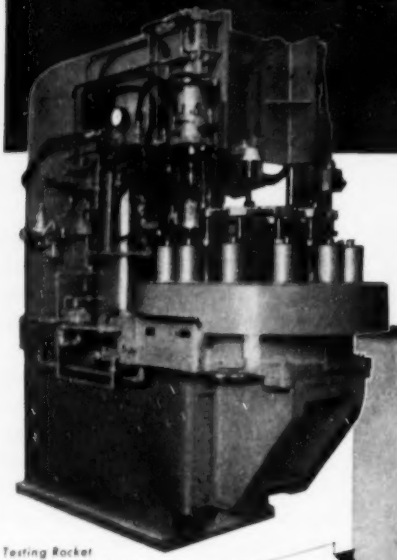
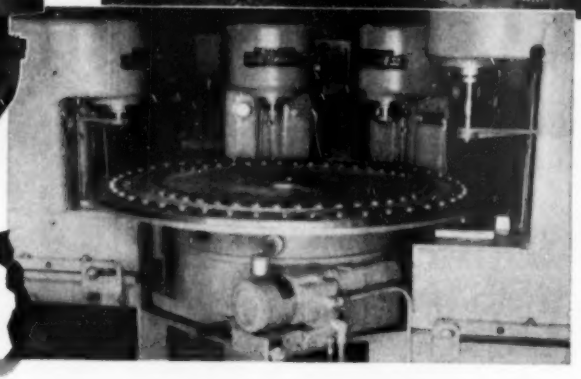
—multiply production speeds by faster *continuous* parts loading





Testing Rocket Bodies Hydrostatically—Automatically—

A Production Tip for Better Ordnance and Industrial Jobs

adds further versatility to the rapid action of

MULTIPRESS®

Thousands of Multipress users are daily proving—on both industrial and ordnance jobs—that automatic rotary feeding of parts is a sure way to speed up production . . . *and do it safely*. Synchronized and interlocked with the machine action, the table automatically turns, simultaneously carrying one loaded part to the work station and the preceding part on to the ejection station where it is either manually or automatically ejected.

As illustrated above, one or several operators working safely out of reach of the ram action, simply load parts or multiple-part assemblies into holding fixtures evenly spaced around the dial. No lost machine production time for loading or unloading the work in process!

Likewise, where the work requires progressive machine operations, more than one production unit can be placed at different work stations around the table.

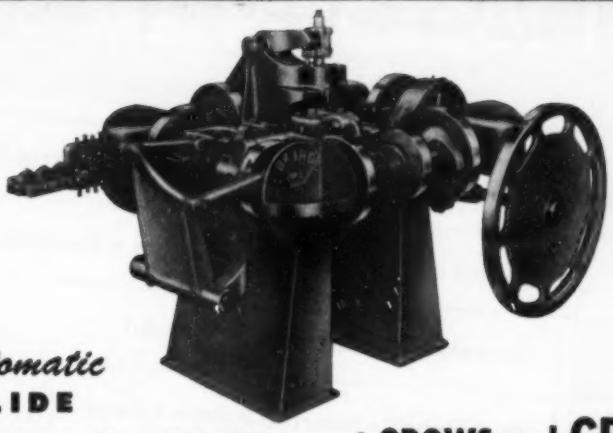
Rotated by oil hydraulic power at speeds from 10 to 70 indexes per minute and available in six or twelve station models, the Denison Index Table has wide application. But combined with Multipress—with its wide range of ram action, and 8 frame sizes in capacities from 1 to 50 tons—you have a high speed production machine adaptable to almost unlimited application. One worthy of investigating today! Write.

It's Also An Ideal Rotary Feed For Other Types of Equipment!

DENISON HydrOILics

The DENISON Engineering Co.
1164 Dublin Rd., Columbus 16, Ohio

ASK BAIRD ABOUT IT!



BAIRD *Automatic* FOUR SLIDE

. . . the Machine that GROWS and GROWS and GROWS

Start, if you wish, with the standard (stocked) 4-slide, which in itself is remarkably versatile in forming hundreds of articles from wire and ribbon metal.

Then when conditions demand . . . a call for either even greater versatility of production or a change in certain products . . . you may add one or more attachments to the standard model, so designed that "machine growth" is simplified and practical.

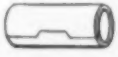
Thus, with gradual investments, you will build your Baird 4-slide to a full production unit capable of turning out the widest variety of wire and ribbon products. Here is a list of attachments easily added . . . but naturally, not all on one machine . . . as they might become too complicated.

1
Horizontal Press Attachments

2
Form Raising Attachment

3
Pin Pulling Attachment

4
Setting Attachment



5
Secondary Cut-Off Attachment

6
Nail Point (Vertical Cut-Off) Attachment

7
Vertical Forming Attachment

Baird engineers will gladly develop tooling from your parts or specification. "Ask Baird about it!"

the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

48A32

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DRILLS	Radial • Large & Small Uprights • Multi-Spindle
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GRINDERS	Cylindrical • Internal & Face • Gear
PANTOGRAPH MACHINES	Universal Pantograph Die Sinkers 2 & 3 Dimensional Engravers & Copy Millers

COLD SAWS	PINION CUTTING MACHINES	BURNISHING MACHINES	SAW SHARPENING MACHINES
CAM SHAPERS	LAPPING MACHINES	COIL WINDING MACHINES	UNIVERSAL TOOL & CUTTER GRINDERS

INSPECTION EQUIPMENT	MECHANICAL & ELECTRICAL COMPARATORS	TOOL MAKER'S MICROSCOPES
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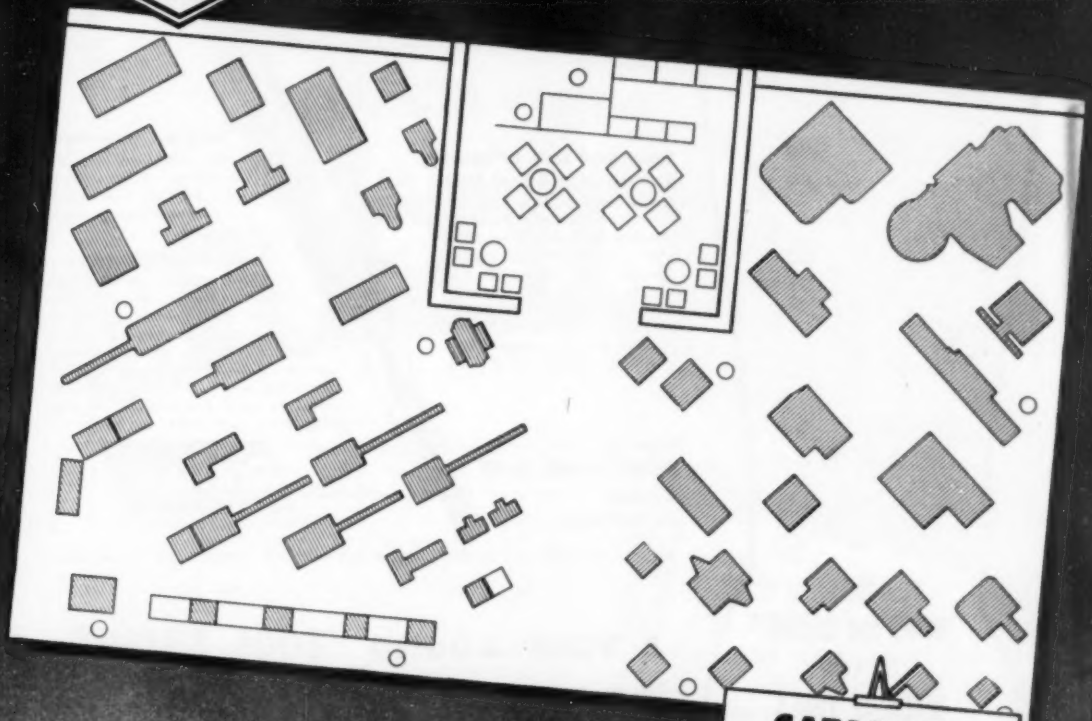

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Write for catalogs on the specific equipment you need — for the production line, tool room or inspection department.

Precision Production and Tool Room Equipment from Small Bench Lathes to Large Boring Mills

COSA CORPORATION

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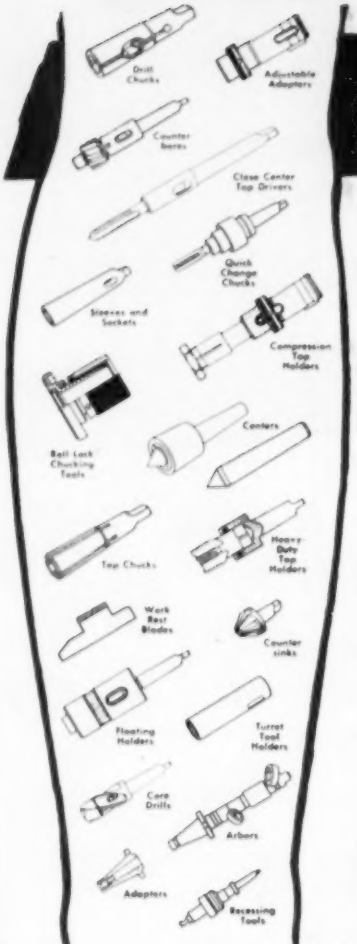

the "ARMS and HANDS" for your MACHINE TOOLS

If you think of a Lathe, Mill, Multi-Spindle Machine, or other Machine Tools as being a human body, supplying power to the parts of the body doing the actual work, then Scully-Jones tools represent the "Arms and Hands".

DRILL STOP

by SJ SCULLY JONES

End Guesswork and Reduce Rejects:
You often require close control of depth for operations — as in center drilling, drilling and reaming — on turret lathes, radial drills and other machines. On these operations, or wherever a quick change arrangement is used in one station for sequence operations, you hold uniform hole depth by using the new S-J Drill Stops. They provide a positive stop which ends guesswork and reduces rejects.

Quick and Easy to Insert, Remove and Adjust Tools:
Simply loosen set screw and slip stop collar from threaded shank for quick insertion or removal of taper shank tools. The threaded lock bushing provides quick and accurate adjustment of the stop collar. Only a quarter turn of the set screw forces the bushing against the shank threads for a positive lock.

Work on Close Centers:
The small body diameter permits you to operate these Drill Stops on close centers and near shoulders or other obstructions.

Trouble-Free Performance:
S-J Drill Stops are made from an alloy steel with all points of wear hardened for long life. The four chip grooves tend to break up and remove any chips from the surface on which it stops. Investigate the use of S-J Drill Stops wherever you require a positive control for depth of hole. Made in 8 sizes having Morse Taper shanks and holes.

Write for BULLETIN NO. 18-50 for data on Drill Stops.

Scully-Jones and Company
1902 S. Rockwell St., Chicago 8, Ill.

YOU GET LOW COST FAST ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

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You can see the S-J Standard Tools (sketched in the column at the left) on display or in operation the year-round, at the Scully-Jones plant. For year-round reference too, you'll find complete information on these and other tools, in the S-J Catalog 600—yours on request, on your company letterhead.

These "arms and hands" — as we like to call them — will help you equip your machine tools for low cost, fast, accurate production.

Whether you select Scully-Jones Standard or Special Tools you can be confident of getting the best that can be produced — the result of 40 years' experience, engineering research, modern equipment, correct materials and expert workmanship. Recently Scully-Jones manufacturing facilities have been further expanded to give you more reasonable deliveries.

Whenever your tooling problems or design programs require outside service, S-J Engineering and Design Service has "heads and hands" to help you. Whether large or small, let us discuss your engineering problems and design programs.

For quick action see the nearest Scully-Jones representative or contact us direct.

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DEVICE

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- Rapid Advance
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¼" drill capacity. 4" stroke. Standard rated spindle free speed 2800 RPM, rated ¼ h.p., maximum developed horsepower ⅓ h.p. at 1500 RPM. Combines fast, safe, flexible air-power, full electrical control and hydraulic feed. Spindle traverse by the Bellows Air Motor with the built-in Electroaire Valve. Spindle rotation by a specially built rotary air motor. Feed rate controlled by the Bellows Hydro-check.

Use it singly for finger touch operation or foot-switch control, or synchronized to automatic work holding devices. Use it in multiple drill set ups with sequence timed operations with a single chucking. The HYDRAIR can be mounted at any angle. Its compact, space-saving design simplifies installation. Its low voltage electrical controls simplify wiring, assure complete electrical safety for operator and machine.

In addition to the standard 2800 RPM spindle speed, the HYDRAIR is available in any one of five additional spindle speeds: 17,000, 5,000, 2,800, 1,450, 800 and 500 RPM to meet a wide range of requirements in drilling ferrous and non-ferrous metals, plastics and woods.

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See the HYDRAIR at the ASTE SHOW CHICAGO AMPHITHEATRE, BOOTH 1424, MARCH 17-21 or write today for detailed information
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"Controlled-Air-Power for Faster, Safer and Better Production"

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Built to the Highest American Standards of Accuracy, Productivity and Convenience

With the attachments available, these German-designed and built lathes represent the maximum in versatility . . . production lathes built to tool room standards, recognized universally for high precision and top performance.

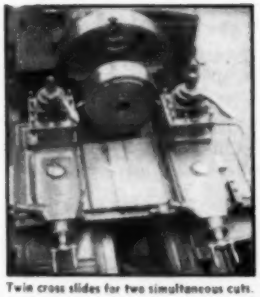
Specifically, the SCHAERER HIGH DUTY LATHE offers:

- . . . all gears in headstock hardened and ground.
- . . . front and rear main spindle bearings lubricated by separate oiling system.
- . . . main shaft motor-driven through forward and reverse multidisc clutches.
- . . . multiple-screw cutting attachment provided on headstock.
- . . . quick-change gear and carriage equipped with one-shot oiling system.
- . . . carriage automatically released by friction cutch in case of overload.
- . . . cross slide equipped with ball catch stop for accurate adjustment of depth cutting.
- . . . adjustable carriage stop provided for longitudinal turning.

Full detailed specifications are contained in illustrated brochure available promptly on request.

Come and see these lathes in operation under power. Bring samples for test purposes if you wish.

Variety of tooling combinations available.



Twin cross slides for two simultaneous cuts.

Condensed Specifications

18" to 20" swing available.

20" to 22" swing over gap.

Distance between centers from 20" to 120".

Hydraulic Copying Attachment with twin cross slides for facing work and turning between centers.

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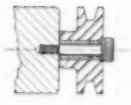
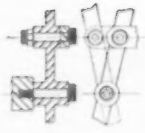
UNBRAKO Shoulder Screw Applications



1. Stationary Shaft or Pivot

A. Idler pulley
B. Idler gear
C. Circular form tool
D. Lever, crank or linkage arm
E. Cam
F. Latch



2. Moving Shaft or Pivot

A. Linkage bar connection
B. Cam
C. Cam follower
D. Ratchet
E. Planetary gear or pinion

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UNBRAKO SHOULDER SCREWS...
uniform, standardized, precision threaded
industrial fasteners...HAVE NUMEROUS APPLICATIONS

You can use these UNBRAKO Socket Head Shoulder Screws as stationary shafts or pivots, moving shafts or pivots, stationary guides, and for stripper plate and pressure pad applications. These UNBRAKO screws have shoulders held to close tolerances, finished threads close to the shoulder, and threads and heads concentric with the body. Write for descriptive literature. STANDARD PRESSED STEEL Co., Jenkintown 1, Pennsylvania.

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3. Stationary Guide

A. Locating pin in jigs and fixtures
B. Latch stop
C. Alignment of stationary members
D. Linkage block
E. Grooved cam
F. Adjusting block

4. Stripper Plate Uses

A. Blanking dies
B. Compound dies
C. Progressive compound dies
D. Drawing dies
E. Redrawing dies
F. Piercing and shearing dies
G. Combination blanking, drawing and piercing dies
H. Double action blanking and drawing dies

5. Pressure Pad Uses

A. Cutting-off dies
B. Bending dies
C. Bending and forming dies
D. Assembly dies
E. Double action blanking and drawing dies

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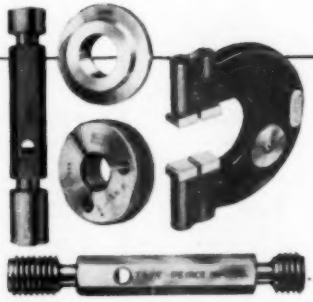
T-P COMPAIRATOR. Positively the most versatile air gage available! It can be used for any type of production measurement from simple diameters to complex multi-dimensional checks.

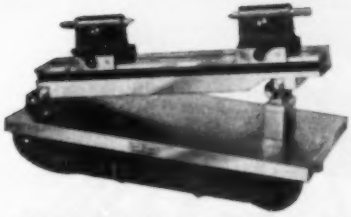
T-P PRECISION GAGE BLOCKS provide honest, enduring accuracy. Fingertip pickup and large size markings on their sides add convenience. No finer gage blocks are made here or abroad.

T-P POWER THREAD GAGING UNIT is the fastest thread gaging method ever devised. Push — and the gage screws into the work. Release the pressure and it stops. Pull — and it disengages.

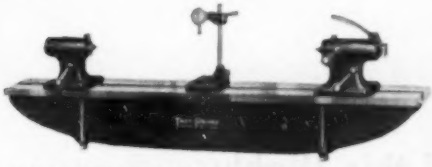


T-P FIXED GAGES. A complete line of standard and special fixed gages for every gaging need.

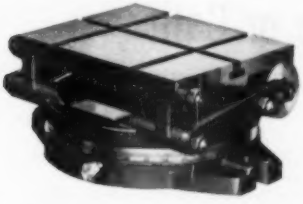
For Setting-Up & Inspecting



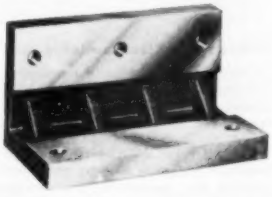
T-P TAPER TESTING FIXTURE combines a Sine Block with a pair of adjustable mounted precision centers. Checks tapers to high degree of accuracy. The T-P surface plate is one of a large line of standard sizes.



T-P BENCH CENTERS simplify inspection work. Have unusual rigidity and permanent accuracy. This is typical of a wide range of inspection tools available at Taft-Peirce.



T-P ADJUSTABLE ANGLE PLATE has a tilting table mounted on a rotating base, graduated from 0 to 90 degrees in each direction. Simplifies setups for machining compound angles.



T-P DUPLEX ANGLE IRONS. Finished inner pads increase accuracy, permit faster setups. Just one example of the many production tools in the Taft-Peirce line.

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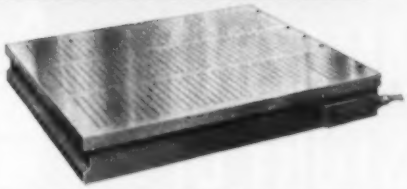
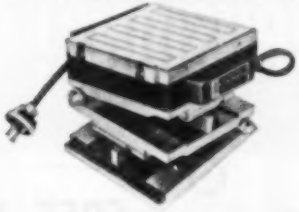
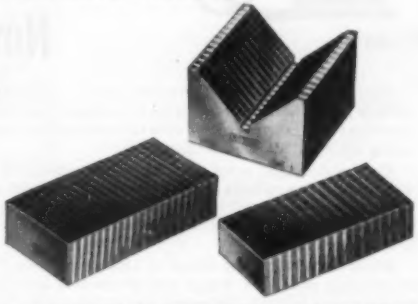


T-P SUPERPOWER MAGNETIC CHUCKS are magnetically more powerful size for size. They provide more versatility, faster setups, greater working surface, and low magnetic losses. Available in wide range of standard sizes or on special order.



T-P SUPERPOWER MAGNETIC SINE-ANGLE CHUCK speeds positioning of tricky angle grinding jobs. Gage blocks placed between roll and base plate assure high precision.



T-P UNIVERSAL MAGNETIC PARALLELS AND V-BLOCKS. Available in stock sizes. Special sizes made to order.

For the complete story on these items and many more, get your copy of the Taft-Peirce Handbook.

T-P means Top Precision

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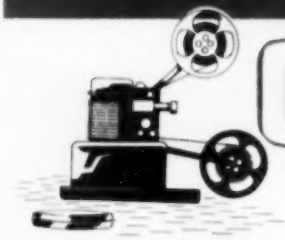
New, Color Film Tells the

AMAZING STORY OF ALUMINUM EXTRUSIONS!



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Yours for the asking...the loan of this full-color, 30 minute sound film which explains the extrusion process and shows actual fabrication of several well-known products using extruded aluminum shapes.

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- Designing with Aluminum Extrusions
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- Finishes for Aluminum
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A few of many models to make your gaging job better . . . easier.

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DuBo*

Plug Gage with High Visibility

COLOR FLASH Handles

Definite check, self-piloting, long wearing! As much as 70% to 80% lighter than cylindrical plug gages of equivalent size

*U.S. and Foreign Patents Granted

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Shockproof Mechanism standard on most models

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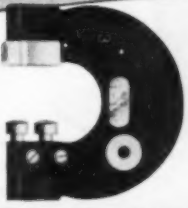

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

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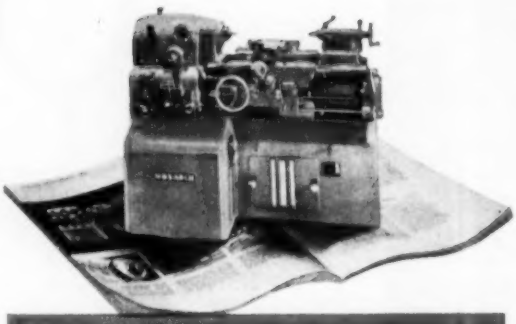
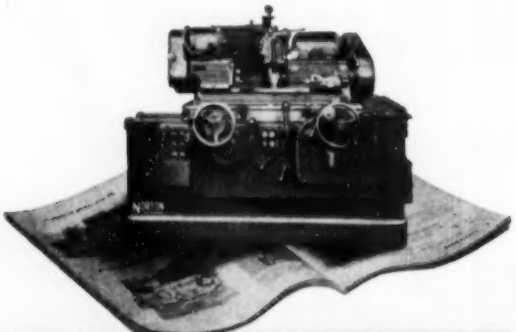
These services are designed to make the buying and selling of machine tools easier, faster and less costly, by means of improved techniques in the design and distribution of printed product information.





for machine tool builders

If you need a new catalog—

you can have it expertly designed by men who have produced many outstanding catalogs for leading machine tool builders;

you can have it expertly printed, at moderate cost, by an organization which handles more manufacturers' catalogs than any other—in 1951, over *thirty-eight million* copies.

If you need effective distribution for your catalog—

you can have it delivered to selected specifiers and buyers of machine tools in leading metalworking plants;

you can have it delivered in either of two ways—(1) by mail or (2) pre-filed in MACHINE TOOL CATALOGS, a bound, indexed collection of machine tool builders' catalogs.

You can order these catalog design, production or distribution services separately, or in any combination, as your needs require.

Sweet's

Sweet's has designed, produced and distributed catalogs for scores of machine tool builders whose names are known throughout the industry. All of this experience and Sweet's complete facilities will be used to get the right information on its clients' products in the hands of the right people.

catalog services for buyers of Machine Tools

through Sweet's Catalog Service

James & Lamson Machine Co.

for machine tool buyers

Many people on the buying side and on the selling side of the machine tool market have expressed the need for a *pre-filed* catalog distribution service exclusively for this field. Therefore Sweet's believes that, the machine tool builders who employ any of its services will also choose to have Sweet's distribute their catalogs in pre-filed form, via MACHINE TOOL CATALOGS.

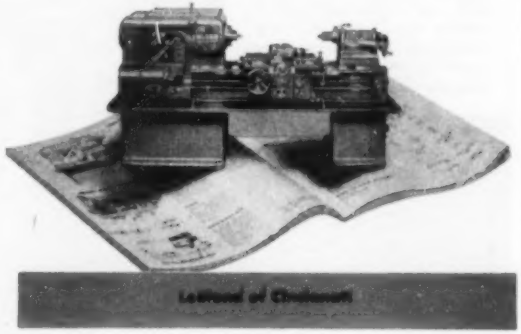
So, whenever you need up-to-date buying information—

you will have a comprehensive file of catalogs of leading machine tool builders, in bound volume form, in which you can readily compare types and makes and select the companies whose sales representatives you wish to see.

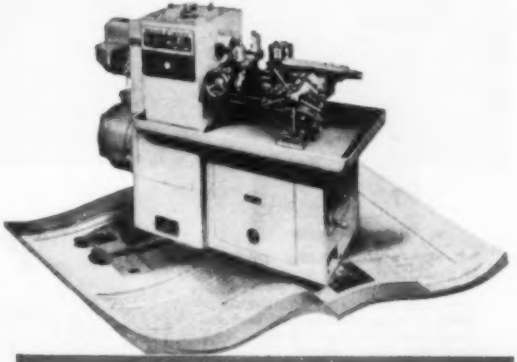
MACHINE TOOL CATALOGS will be organized in sections, as follows:

1. drilling and boring
2. milling
3. turning
4. planing
5. grinding
6. shearing and pressing

Distribution of MACHINE TOOL CATALOGS is scheduled for the fall of 1952. (NOTE: *until then, please refer to Section 1, Sweet's File for the Mechanical Industries.)*



Lehmond of Cincinnati



The Warner & Swasey Company

Catalog Service

DIVISION OF F. W. DODGE CORPORATION

119 WEST 40TH STREET,

NEW YORK 18, NEW YORK

. . . How to uncover Extra

Most tool engineers today know the advantages of using Self-tapping Screws. This one-operation fastening saves time needlessly lost tapping for machine screws, molding inserts in plastics, bolting, riveting, or soldering.

But they still may be missing some substantial *extra* savings, because all Self-tapping Screws are not alike. *Planned* savings don't always *pay off* — unless you specify "P-K".

When Parker-Kalon developed the *first* Self-tapping Screws, nearly 40 years ago, they learned how to maintain, in every screw, the uniform hardness *and* toughness, the sharp threads and accurate size, the consistent dependability that keeps assembly humming. That's why every screw in every box can be *guaranteed* first quality.

P-K SELF-TAPPING SCREW BULLETIN, 48 pages, describes all types, tells where and how to use what screw, shows typical applications. **P-K ENGINEERING STANDARDS,** 48 pages, gives standard head and thread dimensions of all P-K Screws, other useful data. Free on request.

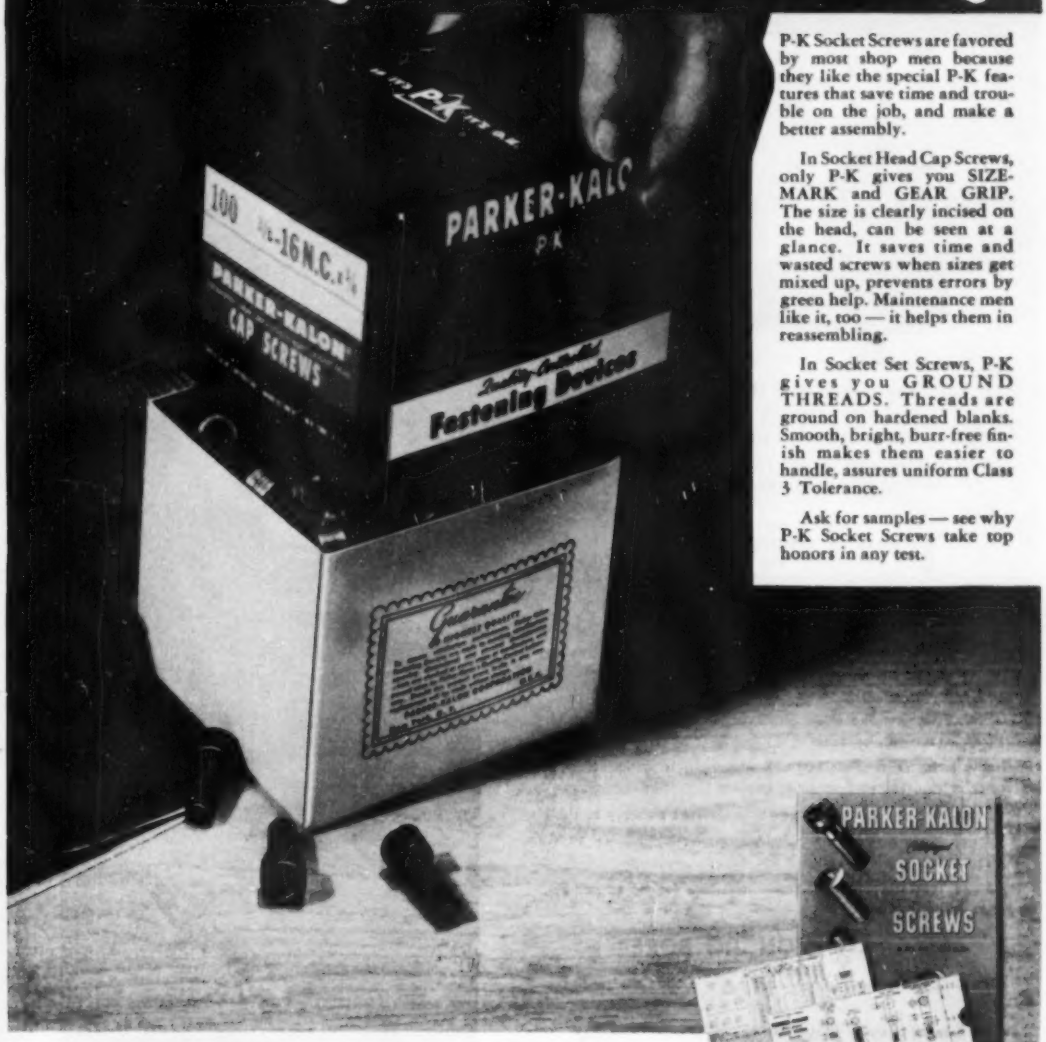
PARKER-KALON

The Original **SELF-TAPPING SCREWS**

Cold-forged **SOCKET SCREWS**

AND OTHER FASTENING DEVICES

Savings in tool assembly



P-K Socket Screws are favored by most shop men because they like the special P-K features that save time and trouble on the job, and make a better assembly.

In Socket Head Cap Screws, only P-K gives you SIZE-MARK and GEAR GRIP. The size is clearly incised on the head, can be seen at a glance. It saves time and wasted screws when sizes get mixed up, prevents errors by green help. Maintenance men like it, too — it helps them in reassembling.

In Socket Set Screws, P-K gives you GROUND THREADS. Threads are ground on hardened blanks. Smooth, bright, burr-free finish makes them easier to handle, assures uniform Class 3 Tolerance.

Ask for samples — see why P-K Socket Screws take top honors in any test.

Teamed Up to help you Step Up assemblies

The P-K Assembly Engineer is a fastening expert, fully qualified to help you plan faster, better, lower cost assemblies.

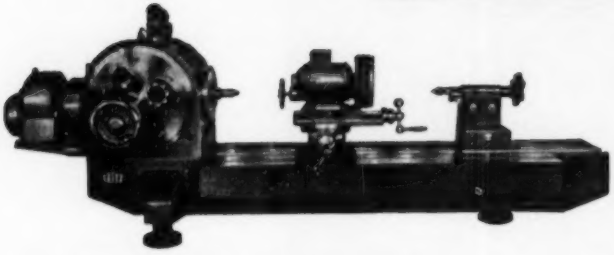
Your local Industrial Supply Distributor is an expert in procurement, with complete experience and facilities for simplifying your supply problems. Let them help you.

P-K SOCKET SCREW BULLETIN, 16 pages, describes all types, and illustrates quality-control back of P-K guarantee. **SOCKET SCREW DIMENSION FINDER,** a pocket-size plastic slide chart, gives all essential dimensions of all types. Free on request.

PARKER-KALON CORPORATION, 200 VARICK ST., NEW YORK 14

SCHERR's *most Complete Show Exhibit* *featuring*

PRECISION MECHANICAL AND OPTICAL MEASURING EQUIPMENT



Our complete line plus these new machines

FIRST TIME IN U.S.A.

MICRO-HARDNESS TESTER — SURFACE FINISH TESTER

PERPLEKTOMETER FOR DIRECT INTERNAL MEASUREMENTS

UNIVERSAL MEASURING MICROSCOPE

shown on this page
OPTICAL DIVIDING HEAD
PRECISION JIG BORER

LEITZ OPTICAL DIVIDING HEAD
(SHOWN ABOVE)

Realizing that accuracy in dividing depends to a great extent on true concentricity, the LEITZ head combines for the first time the following exclusive features:

Dual Microscope reading of master circle to compensate for possible errors from eccentricity.

Selective motor drive to main spindle whereby it is possible to true-up center or mounted work by finish-grinding.

Reading of the circle in 5 sec. with a guaranteed accuracy in circle of 2 sec.

Optical setting for tilting motion in one min.

Head and Tailstock readily removable from base for use on grinders, jig borers, milling machines, etc.

LEITZ PRECISION JIG BORER

Optical Scales and Micrometer Microscope for setting and reading in .00005".

Built-in Rotary Table with 10 sec. reading.

The hollow spindle incorporates a setting microscpe which is permanently built-in, not attachable, and adds to the extreme working accuracy.

15° tilt of spindle in either direction permits the drilling of inclined holes on the horizontal table.

GEORGE SCHERR CO., Inc.

200-D LAFAYETTE STREET • NEW YORK 12, N. Y.

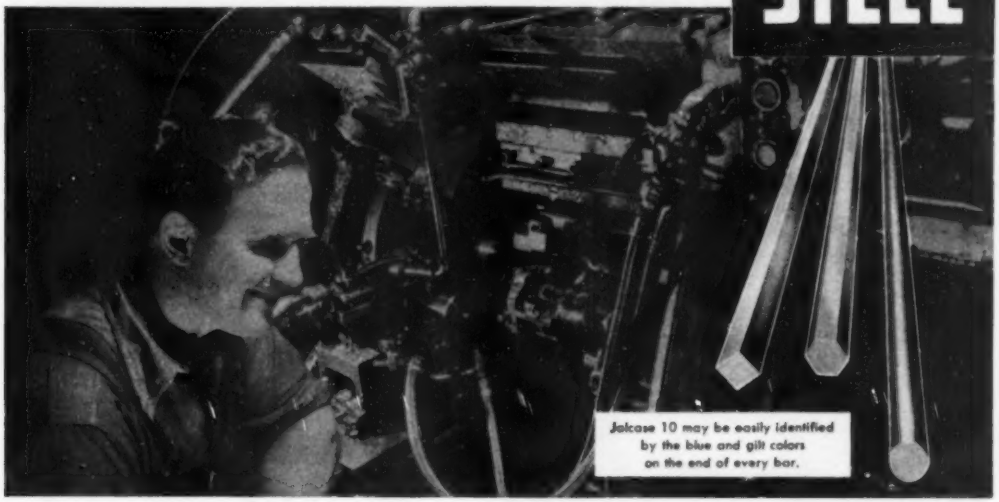
COMPLETE LINE OF PRECISION INSTRUMENTS

JALCASE 10 HELPS YOU

. . . eliminate a production step

. . . machine better cold-finished parts

J&L STEEL



Check these advantages of **JALCASE 10** *that offer you faster, more economical operations . . .*

NO HEAT-TREATING OF FINISHED PARTS REQUIRED

Many times finished part specifications on a job call for a high degree of hardness, but not as high as that obtained through heat-treating the finished part. In these applications, parts manufacturers and machinists have found it profitable to use Jalcase 10 and eliminate heat-treating altogether.

MINIMUM DISTORTION

Although Jalcase 10 is a high-carbon steel, distortion is cut to a minimum through special treatment during the cold-finishing process. As a result, when mechanical properties must be as high as possible and distortion held to a minimum, Jalcase 10 fulfills these rigid requirements.

AMERICA NEEDS SCRAP TO MAKE MORE STEEL
YOU CAN HELP

HIGH MECHANICAL PROPERTIES

Jalcase 10 (A.I.S.I. No. C-1144) has the following cold-finished properties:

Minimum Tensile Strength	115,000 lb/sq. in.
Minimum Yield Strength	100,000 lb/sq. in.
Elongation in 2 inches	7% (minimum)
Reduction of area	20 %(minimum)
Brinell Hardness Range	235—285

PLUS . . . all the other advantages Jalcase steels have over ordinary screw stock:

1. lower cost per unit produced
2. finer finish on completed pieces
3. longer machine-tool life
4. less screw-machine down-time

WANT MORE INFORMATION?

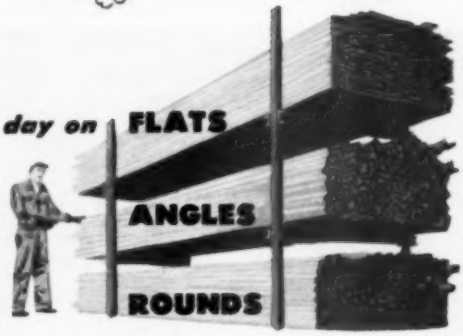
Send for our FREE booklet entitled "You Can Make Them Better with Cold-finished Jalcase." This illustrated booklet gives you complete technical information about *all ten* grades of Jalcase and how they can help you get better results in your machining operations. WRITE TODAY!

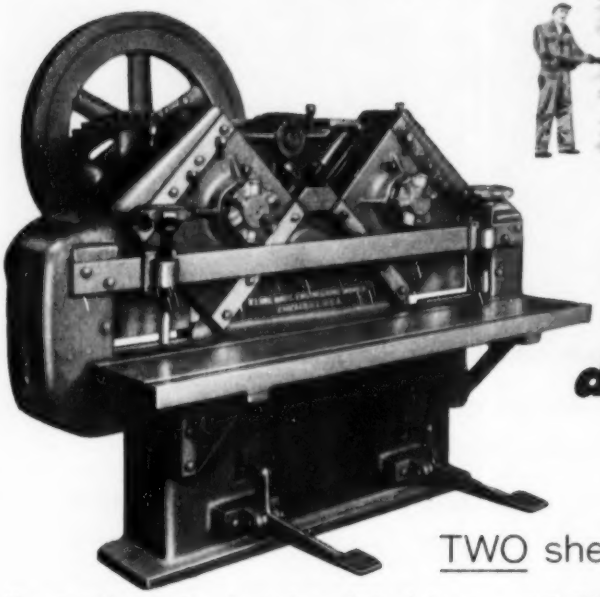
JONES & LAUGHLIN STEEL CORPORATION

402 JONES & LAUGHLIN BUILDING, PITTSBURGH, PENNSYLVANIA

It's the BUSIEST machine in the shop!

...gives more cuts per day on





Kling double angle shears

TWO shears in ONE machine!

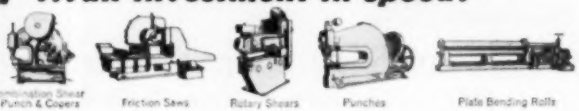
If you're using obsolete, slow-poke methods of shearing, the Kling Double Angle Shear can help you save time and money. This modern compact machine is designed for high speed, high production shearing on both long and short run jobs. Many metal fabricating plants and steel warehouses have found the Kling Shear to be the workhorse of the shop. For instance, one machine will shear round bars and bar angles on the left side while the right side can be used for structural angles and flat bars. The machine is built with the speed and power to handle the bulk of your shearing requirements. For shops with considerable mitre shearing work, Kling Double Angle Shears can be mounted on a turntable to facilitate handling. Automatic hold downs and one-shot lubrication can be furnished when desired. Sizes to handle angles up to 8" x 8" x 1½".

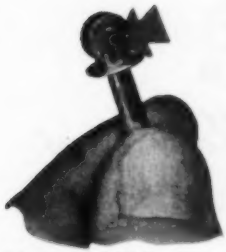
WANT TO CUT SHEARING COSTS?
Find out how this high-production machine can give you more cuts, cleaner cuts on your shearing operations. Write for more information and latest bulletin. Kling Bros. Engineering Works, 1318 North Kostner Avenue, Chicago 51, Illinois.

in our 80th Year

Kling

...an investment in speed!





AS A SHAFT . . . Rollpin serves as an axle for the sparkwheel of a cigarette lighter. No riveting or threading necessary . . . faster assembly. Note flush, clean fit.

AS A DOWEL . . . Rollpin is used here to prevent rotation of a thrust bearing. No reaming, no special locking. Easily removed. Lowest possible dowel pin cost.

AS A CLEVIS PIN . . . here Rollpin holds firmly in clevis, permits free action of moving member. Rollpin application above is with the plate of a home workshop tool.

AS A KEY . . . Rollpin demonstrates its ability to do away with precision tolerances, in this heating system damper arm. Faster, cheaper and more satisfactory than usual assemblies.

AS A STOP PIN . . . in this application, Rollpin is shown in a ratchet wrench adaptor. With its light weight and high shear strength, Rollpin functions perfectly . . . cuts assembly costs.

AS A SIMPLE FASTENER . . . Rollpin replaces a set screw in pinning a gear to a shaft. Assembly time is shorter, service life longer. Vibration-proof flush fit. Easily removable.

YOUR IMPORTANT FASTENING JOBS

are cheaper . . . faster, with ROLLPIN

TRADE MARK

Rollpin is a pressed-fit pin with chamfered ends. It drives easily into holes drilled to normal tolerances, compressing as driven. No reaming, no tapering, no extra assembly steps required. Rollpin fits flush, *locked* in place by the constant pressure it exerts against the hole walls. Can be inserted with automatic press, or by hand—removable with a drift or pin punch.

Rollpin is reusable again and again.

Elastic Stop Nuts with the famous red collar are another ESNA product

MAIL COUPON TODAY. If your present operations or plans include the above applications—or set screws, rivets, hinge pins, cotter pins, pivot pins, taper pins—you can't afford to be without complete details on Rollpin. Write now—find out how much faster and cheaper Rollpin can do the job.

Section R1-39, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, N. J.

Please send me the following free information on ESNA self-locking fasteners:

☐ Rollpin bulletin and sample Rollpins ☐ AN-ESNA conversion chart
☐ Elastic Stop Nut Bulletin ☐ Here is a drawing of our product. What fastener do you recommend?

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____

3 famous SIP Measuring Machines

with built-in standard scales

for absolute measurements to .00005 in.

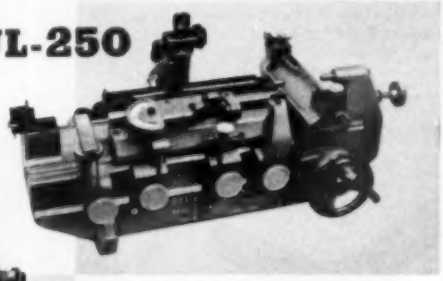
MUL-250

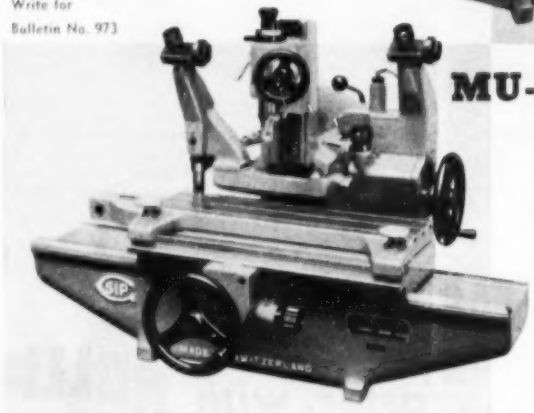
SHOP GAUGE MEASURING MACHINE

for the inspection of internal and external lengths and diameters, profiles, threads, etc.

Measuring range . . . . . 10"
Maximum diameter to be measured . . . 4"
Maximum length of threaded parts admitted 16"

Write for Bulletin No. 973





MU-214 B UNIVERSAL MEASURING APPARATUS

for the inspection of all kinds of gauges, tools, components, internal and external threads, racks, tracings, etc.

Measuring range . . 16" × 4" × 6"
Dimens. of cast iron table $19^1/_4$" × $5^1/_2$"
Dimensions of glass table $16^1/_2$" × $4^1/_4$"

Rotary table for measurements in polar coordinates, dividing head, goniometric microscope, special microscopes for various purposes, etc.

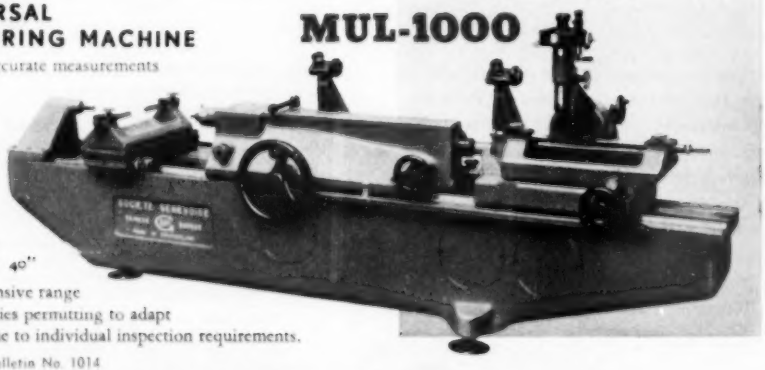
A most versatile measuring apparatus.

Write for Bulletin No. 1016

UNIVERSAL MEASURING MACHINE

for most accurate measurements

MUL-1000



Measuring range . . 40"

Comprehensive range of accessories permitting to adapt the machine to individual inspection requirements.

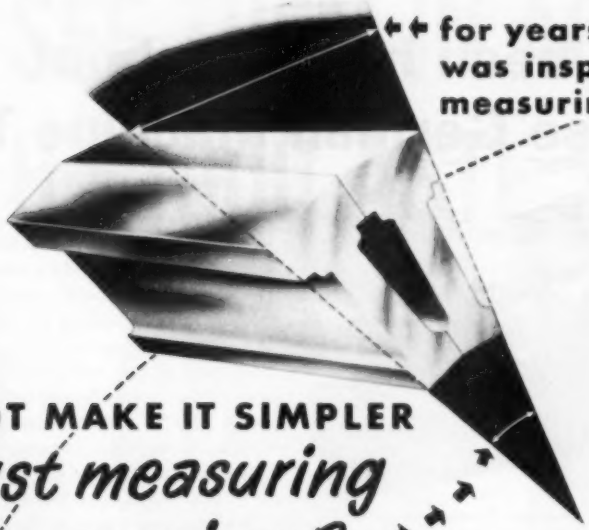
Write for Bulletin No. 1014

AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS AND MEASURING EQUIPMENT

100 East 42nd Street NEW YORK 17, N.Y.

BOOTH 1917
ASTE SHOW



← for years an angle was inspected by measuring this line

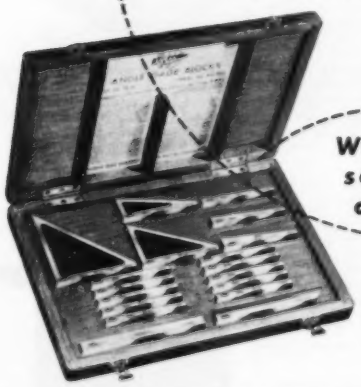
WHY NOT MAKE IT SIMPLER BY *just measuring the opening?*

For years an angle was inspected by measuring a line. Why not measure the opening speculated Webber. It would yield a much more accurate result.

However that required thousands of blocks built like wedges that could measure an infinite variety of angles. The job looked hopeless but Webber nevertheless tackled it.

By trial and error blocks were finally created that could be both added and subtracted by merely changing their position. It enabled a few blocks to measure hundreds of thousands of angles with a direct reading right off the block. Now angle inspection by angle block is becoming the standard of the industry.

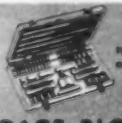
The improvements made in gage blocks have made the name Webber synonymous with the best the industry offers. It is a direct result of devoting all of its attention to just one job. Webber has produced the first wear blocks, the first angle blocks, the first True-Square, the first precision taper inspection, the first Thermo-Guards as well as the first to simplify measurement in thermal expansion. Literature available.



Webber did something about it!

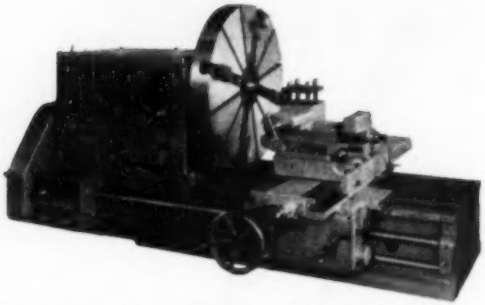
The Webber Gage Company
12901 Triskett Rd., Cleveland 11, Ohio

Webber GAGE BLOCKS



LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

You've been hearing about these German Machine Tools



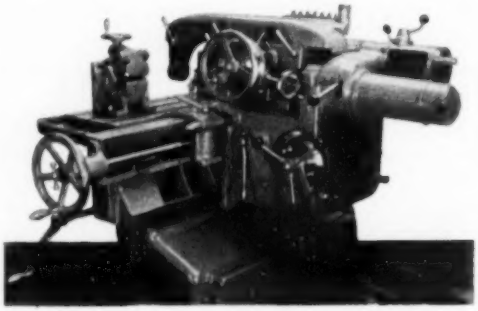
For machining jet engine parts and T-turning bulky work—HEYLIGENSTAEDT Facing Lathe. Turning diameter 51" over bed, 67" in gap. Infinitely variable spindle speeds over 1:6 ratio; 3 back gears; power feed in carriage; lower and upper cross slides. Models available without leadscrew or with movable bed.

These pages can tell only part of the story of the diversity of machines and machining performance you can expect from so wide a range of equipment...all German precision-built...many already on the production lines of leading U. S. metalworking plants.

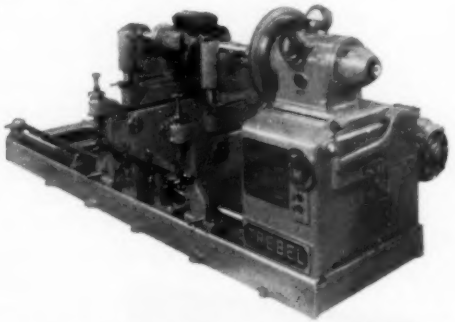
Now you can see them in operation at the Tool Engineers' Show...evaluate them in terms of your own production needs, and talk with principals of the plants who built them. Orban engineers will also be on hand to show you their cost-cutting features.

Delivery is prompt, too, and replacement parts will be available from our Service Center in Cleveland.

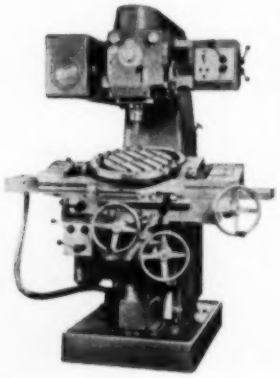
We hope you'll stop in—Booth #1000. If you can't make it, write for literature and let us quote on your requirements.



Swiveling spindle mills accurate keyways and slots—Design of FORST Slot and Keyways Milling Machine permits use of cutters of smaller diameter than width of desired slot or keyway, compensating for errors in cutter size or machine operation.



Checks unbalance of rotating parts in 60 seconds—TREBEL Dynamic Balancing Machine needs no special operator skill. Unique principle, uses a counter-force to compensate for unbalance; no complicated set-ups; gives direct, accurate readings in simple units.

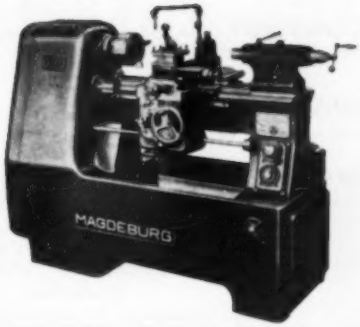


Vertical, downfeed milling and jig boring in one machine—In one set-up of the HURTH V10a, longitudinal traverse of tiltable worktable handles vertical milling; longitudinal traverse and graduated downfeed of cutter spindle does downfeed milling; spindle downfeed performs jig boring. For precision work on jigs, fixtures and other tools; also adaptable to production runs.

Close tolerance grinding of very thin work—Spindle of REINECKER Rotary Face Grinder can be adjusted within .000039" while operating and tolerances from face-to-face of workpiece held within .00004" to .00008" on disc type control valves, space rings, gear shaper cutters and similar parts. Automatic work cycles

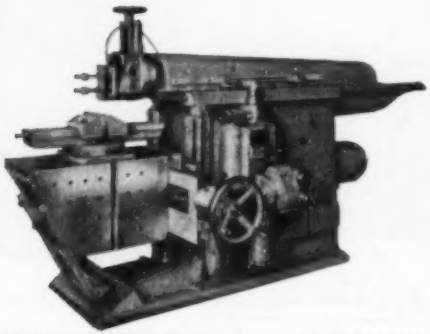
NOW SEE THEM IN ACTION BOOTH #1000 ASTE SHOW

Uniform, concentric twist drill grinding—Planetary drive gear system on CAWI-SPIRAL machine consecutively grinds two- and three-lip twist drills from .078" to 1" diameter ...assures accurate drill angles.

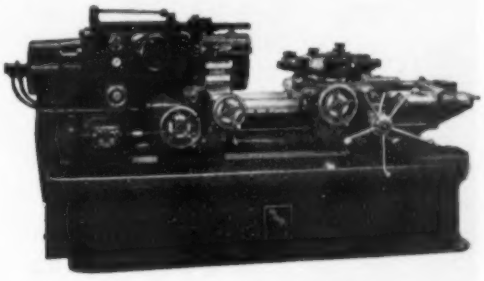


Simplified lathe for fine finishing and high-production—MAGDEBURG Precision Lathe with V-belt drive provides accuracy of precision boring machines...does work of fine finishing lathes in around-the-clock production. Includes contour attachment.

Hand screw machine and turret lathe for precise small runs—The HESTIKA provides single lever control for collet; normal spindle speed, threading spindle speed and reverse and spindle brake. Simple to set up, extremely fast operation.



Low-cost, high-production shaping—In KLOPP High-speed Shapers, cutting head travels to the work. 3 hydraulic types with 26" to 39½" strokes; 4 mechanical models, stroke lengths from 11⅝" to 26⅝"; 7 traversing models with up to 40" stroke for workpieces 6' to 18'.



Ultra-precision machining at high-production rates—SCHEU Turret Lathe is modern in every design and operating detail for modern production-line needs...same models as shown and sold at recent Paris Exposition. 16 spindle speeds from 15-1500 rpm. Hydraulic pre-selector.

We have heavy equipment, too—lathes, milling machines, jig borers, broaching machines. Ask our engineers about them.

KO CO. INC. INDUSTRIAL IMPORTERS

KURT ORBAN COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Ave., Cleveland 3 • 19450 James Couzens Highway, Detroit

Canadian sales by European Machinery Ltd., 11 King St. West, Toronto, Canada

HOBBING PRESSES
are BETTER — BUILT BY M & N!

M & N 1,000 TON PRESS

Capacities from 100 to 2,000 tons

1 **ECONOMICAL** Low initial cost and low operating costs make M & N Hydraulic Hobbing Presses outstanding performers in the hobbing field.

2 **COMPACT** Sturdy construction with all parts self-contained mean a minimum of floor space—the 1,000 ton press illustrated: 48" x 48"—and lower overhead charges.

3 **ENGINEERED** Built to exacting specifications, M & N presses perform like precision instruments. Quick, easy response—accurately—means instant hobbing action.

4 **PRODUCTIVE** Press illustrated: 21" diameter ram has a 4½" stroke; each of 4 columns is 5¾" diameter; opening is 14" high, 17" from left to right and 30" from front to rear; press is operated by 3 hp motor.

M & N Presses are outstanding in performance—outstanding in production!

Made by specialists in Hydraulic Hobbing Presses.

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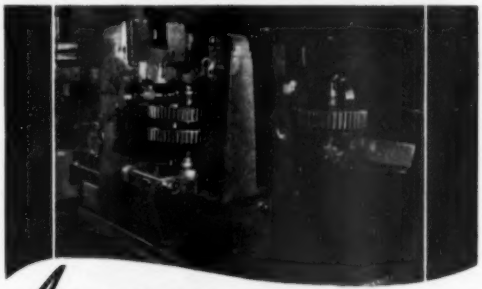

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Brad Foote Gear Works, Inc.,
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has purchased and will operate
as its subsidiary the

PITTSBURGH GEAR COMPANY

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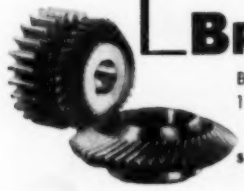
PITTSBURGH 22, PA.

- For more than thirty years, the **PITTSBURGH GEAR COMPANY** has designed and manufactured gears chiefly for the mining and steel industries. It has been relied upon for two well-known products: "Armored" Gears and Crane Track Wheels.
- The Pittsburgh Armoring Process is a unique development, guaranteed to give gears and wheels five times the life of untreated, and one-and-one-half times the life of oil-treated gears and wheels.
- As a wholly-owned subsidiary of **BRAD FOOTE GEAR WORKS, INC.**, **PITTSBURGH GEAR** will continue, and expand, its operations as a principal supplier of all types of gears and crane wheels for steel mills, mines, and industry in general. A stock of gears and parts for mine loaders, cutters, and locomotives will be maintained.
- The full research and development facilities of **BRAD FOOTE GEAR WORKS**, and its other subsidiary, **AMERICAN GEAR & MFG. CO.**, will become a part of the over-all service offered by **PITTSBURGH GEAR**. Thus a well-established gear manufacturer is strengthened by its affiliation with one of America's leaders in the gear engineering and manufacturing field.
- Your inquiries are invited.

Truman L. Gunderson



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Bishop 2-1070 • OLympic 2-7700
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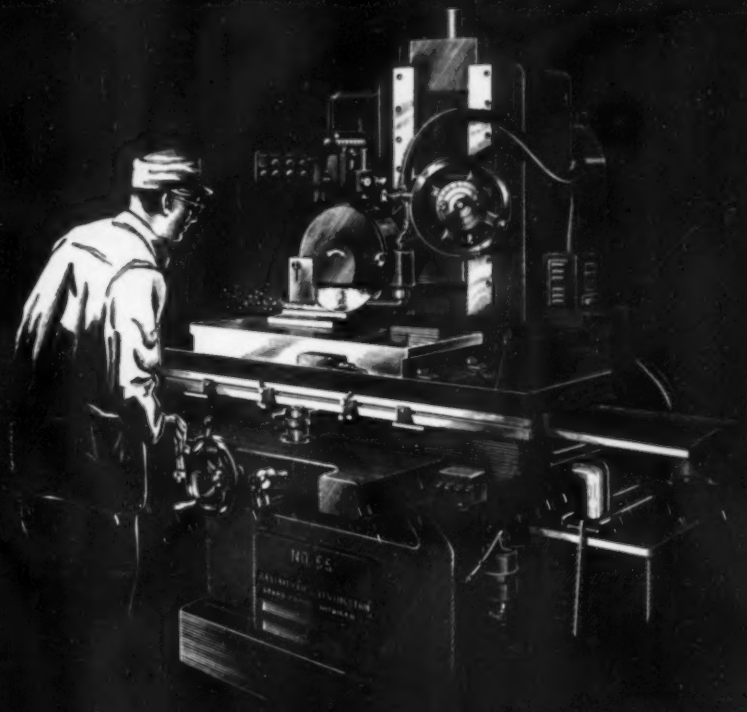

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Grand Rapids Grinders
—World's finest

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Has built-in automatic by-pass for protection against excessive pressure; also compensates for wear. Capacities to 50 g.p.m.

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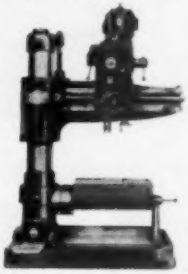

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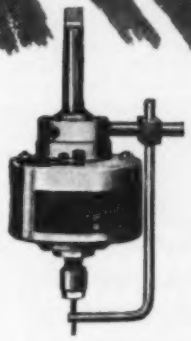

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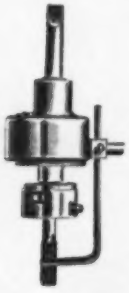

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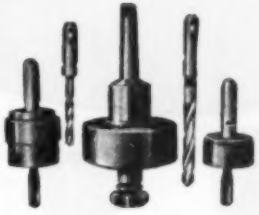
For through holes where work is drilled and then re-handled and tapped.



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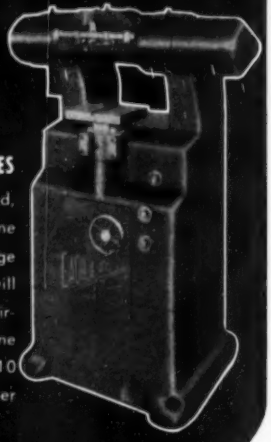

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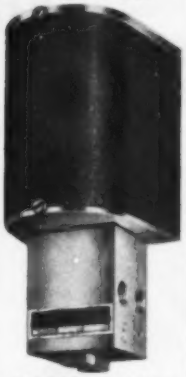

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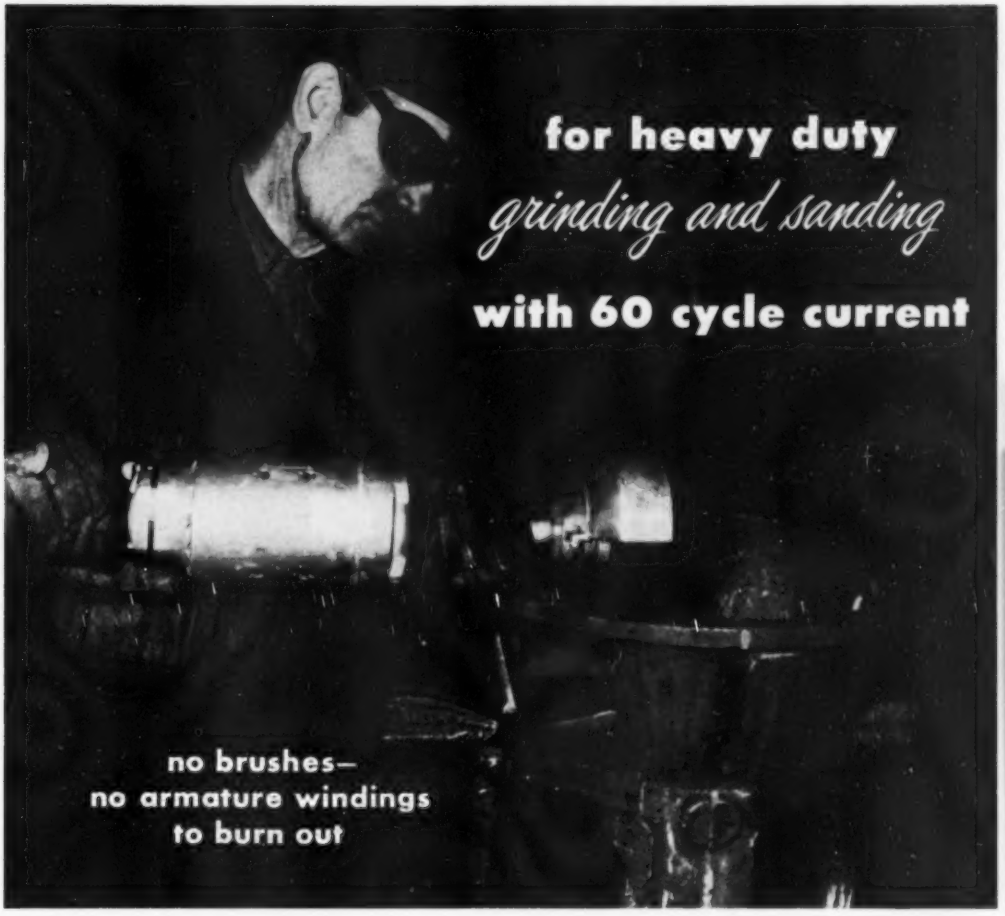

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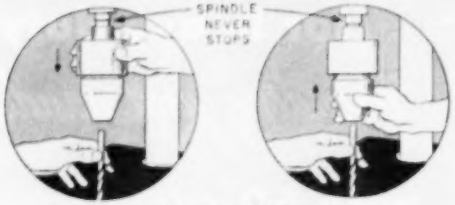

Here's all there is to changing tools:

1. Grip sleeve—pull down—jaws open automatically—tool is released.

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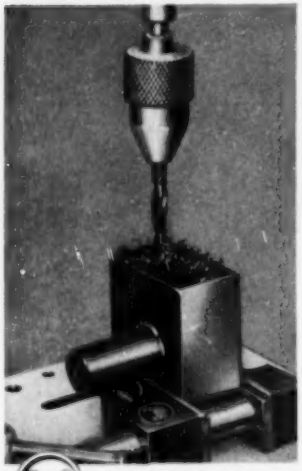

Save *time*—no more hunting for keys, collets or wrenches. Save *tools*—smooth, hardened and ground jaws grip tight without chewing into tools. Automatically self-centering...grip increases with load. Save *money*—one spindle does the work of several. For uninterrupted, precision drilling get Wahlstrom—the only fully-automatic chuck...also used for spotting, drilling and reaming in boring or milling machines. They will also save money in lathe work for burring, turning, filing. Holds two ranges of straight shank tools: from 1/64" to 3/8"; and from 1/32" to 1/2".

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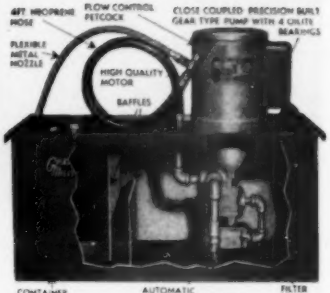

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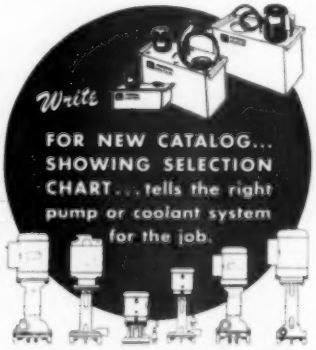

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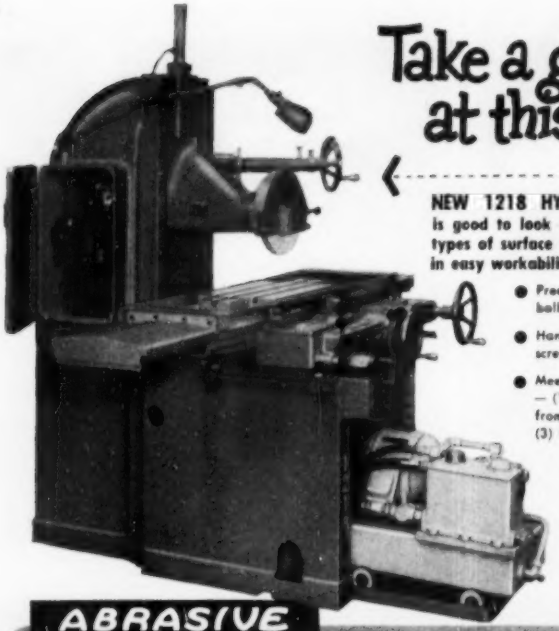

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● This half-tank section, 14½ inch diameter by 24 inches deep, was drawn from a 38½ inch blank 0.105 inch thick in 20 seconds by the Schnell continuous process in a single operation. Formerly these half-tanks required three drawing and two annealing operations and scrap was running as high as 50%. Now with Schnell continuous process, scrap has been reduced to 1% or less and production has been increased tremendously.

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Patented Cutting Off Blades

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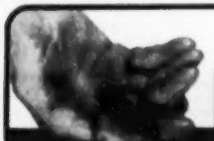

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IN 11 SIZES
No. 6 to 1"
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Here is the faster, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work now—save money too!

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FAMOUS EUROPEAN MACHINE TOOLS

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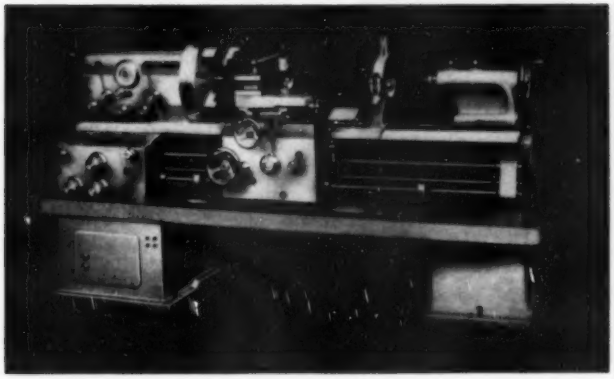
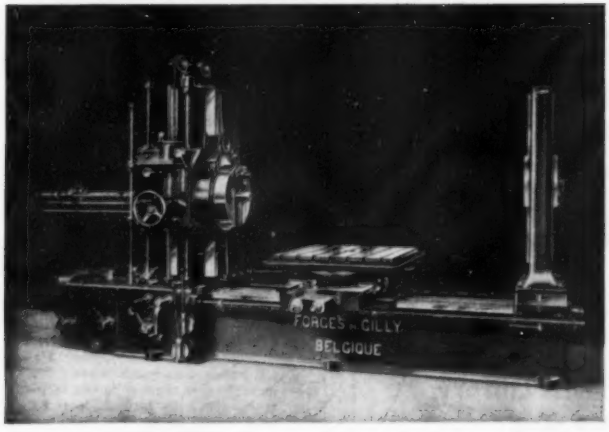
FOR FAST DELIVERY TO THE U.S.A.



DEMOOR "MAGIC EYE" MODEL 821 (19¼" SWING)
GILLY MODEL AFMF80 (3 3/64" SPINDLE HORIZONTAL BORING MACHINE)



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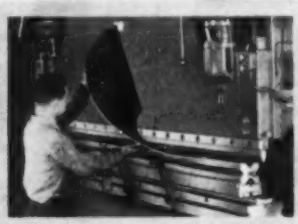

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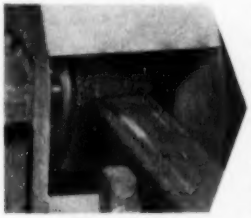

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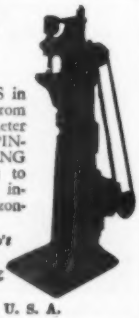

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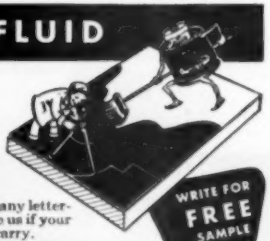

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These are the words of Lenin, father of Russian Communism. Quoted from page 191, volume xxi, of his Collected Works, they were printed recently in a metropolitan newspaper.

This is the announced goal of the Politburo, and it is the direction in which many patriotic citizens fear we are headed. For example, Congress has just appropriated $87 billion to be spent during 1952, and enacted taxes estimated to produce only $71 billion. The deficit is to be added to our national debt, already $259 billion; and this deficit will depreciate the national currency by another $16 billion.

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2. Provide taxes to pay all obligations as we go.
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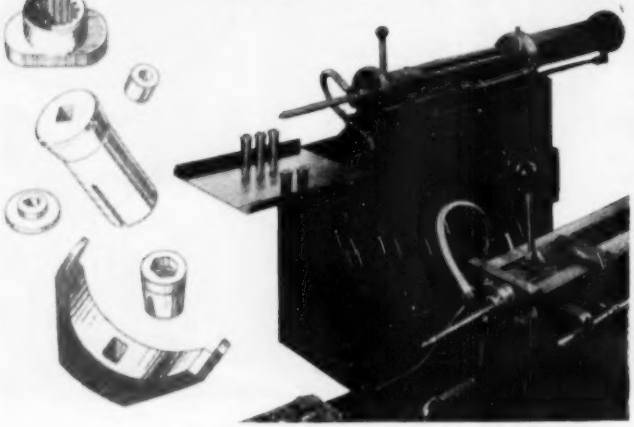

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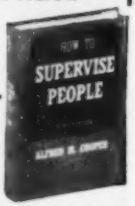

THIS outstanding book is simple, easy to understand, easy to read, yet gives really practical facts of better on-the-job supervision. It covers all the typical supervisor jobs and problems of hiring, discipline, preventing accidents, promoting teamwork, training workers, delegating authority, labor relations, etc. It makes plain helpful techniques for handling them, with examples of typical problems and specific solutions now being used successfully in general practice. Question material suited for conference training is also included.

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- prepare conference plans
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- provide recreational areas for workers
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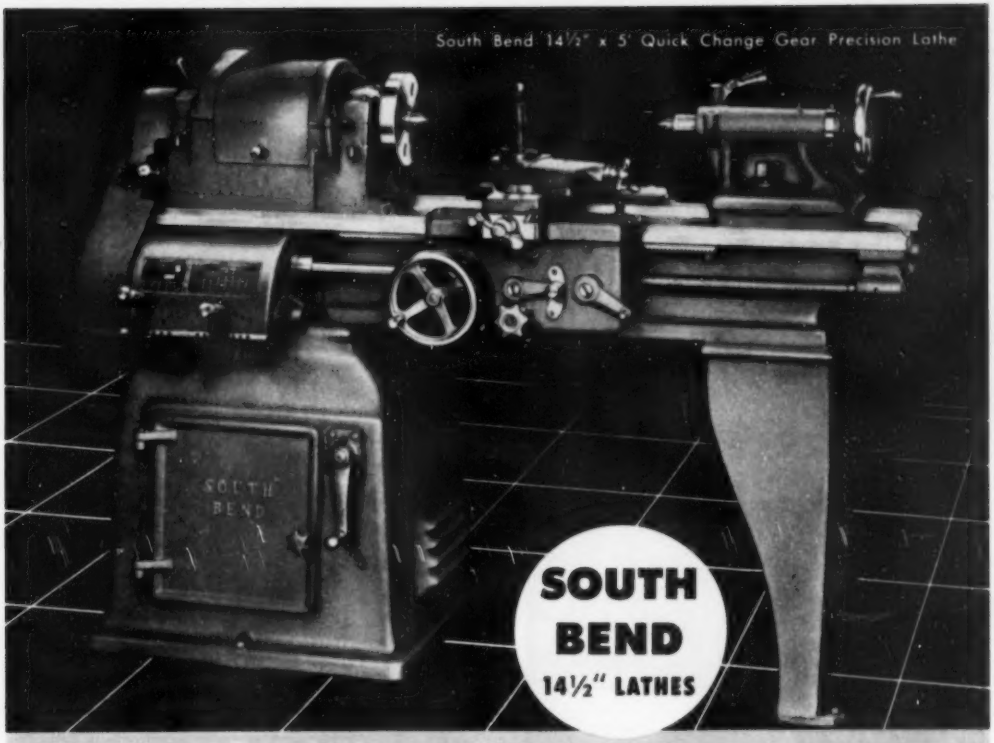

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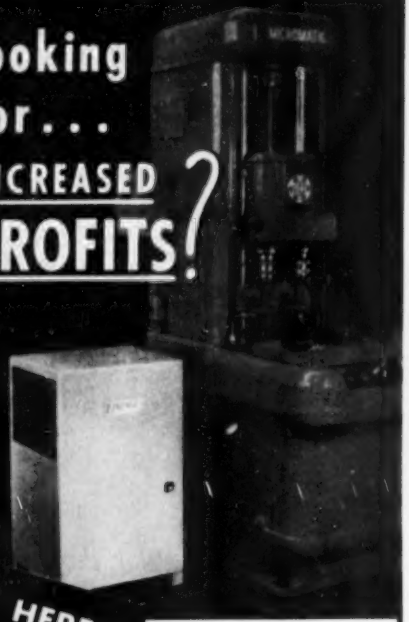

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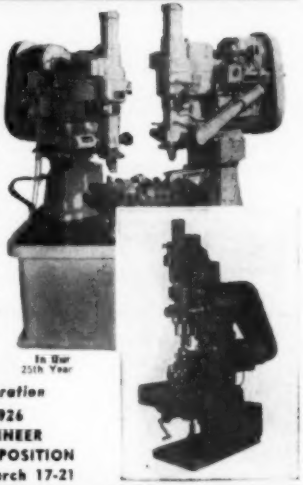

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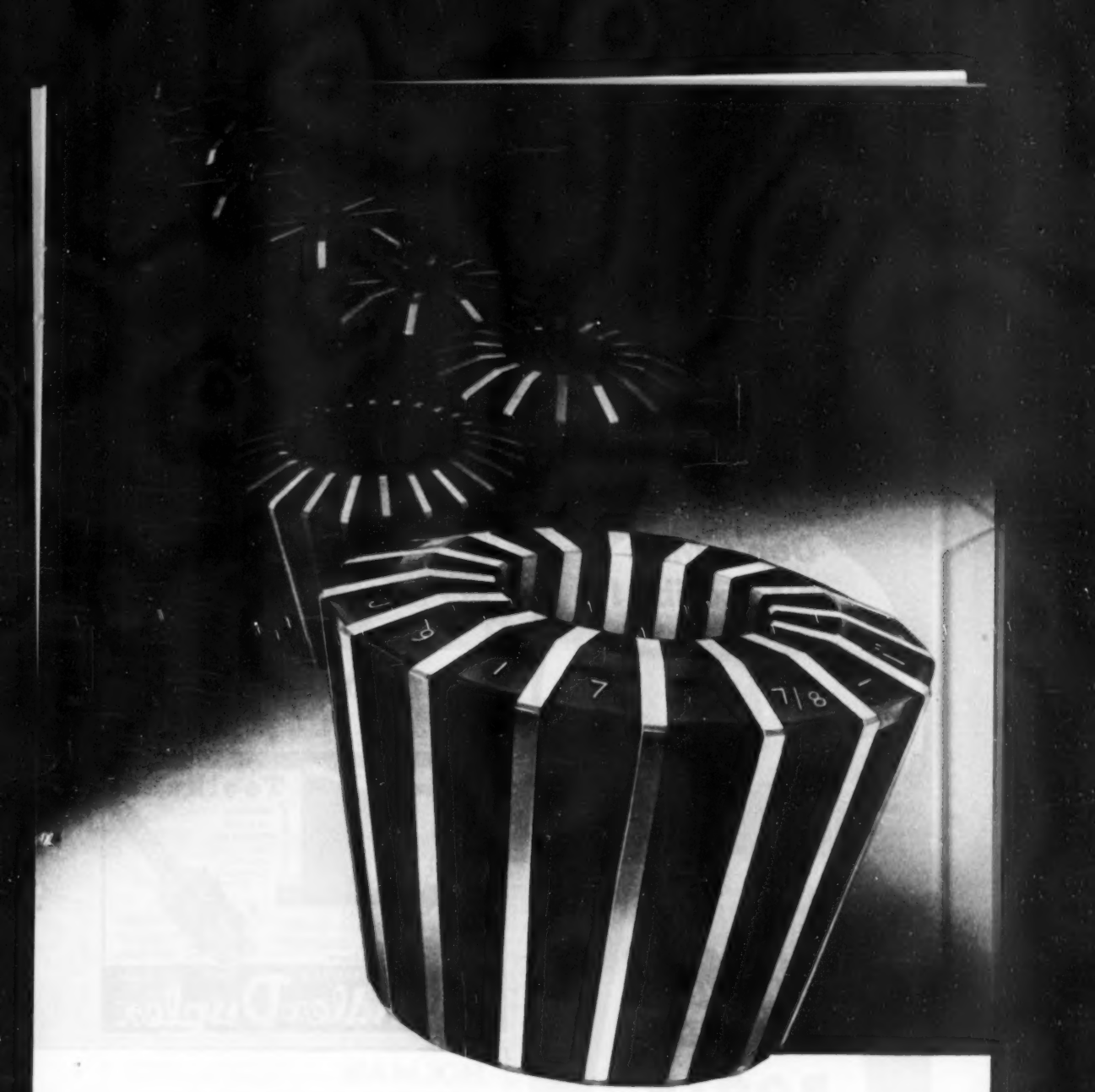

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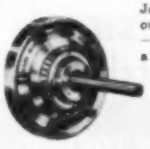

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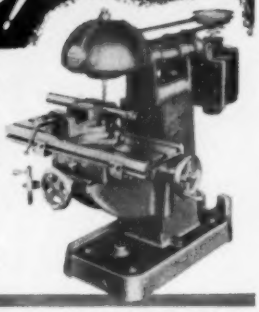

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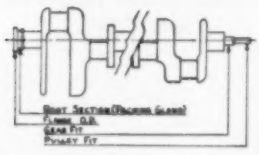
Salvage of rejects speeded by new metallizing alloy

outwears old bearing material 25 times

Automotive manufacturer replaces chrome plating installation with metallizing for salvage of mis-machined crankshafts; steps up output to 10 per hour

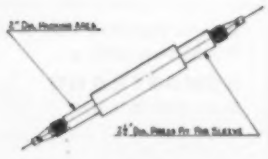
Sprabond Wire, the new self-bonding metallizing alloy, is speeding reject salvage in a wide range of production applications. It has been found particularly valuable in building up parts which have been machined undersize, or damaged by tool marks. Resulting surfaces are extremely hard and, due to their microscopic pore structure, tend to hold considerable amounts of oil. These factors produce excellent wear characteristics, some users reporting increases in service life as much as 25 times that obtained in any other way.

Application is simple and fast; only 3 operations: (1) the part is cleaned or undercut; (2) Sprabond Wire applied; (3) the surface finish-ground. Dovetailing and undercutting often not required and build-up can be carried to a feather edge. No danger of warpage because negligible heat is generated in the part during spraying.



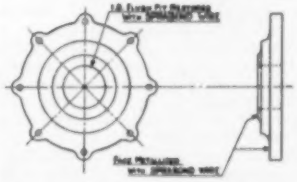
Better and faster than plating

Sketch shows automotive crankshaft of the type being reclaimed in quantity by large manufacturer. These parts were formerly reclaimed by plating, which was slow and expensive. With metallizing, however, production rate is 10 shafts per hour.



Where welding is impractical

Heat warping and consequent straightening costs made welding impractical for salvage of blower shafts such as shown above. Shafts formerly scrapped and replaced are now rebuilt. With Sprabond Wire metallizing, saving is $45.00 each.

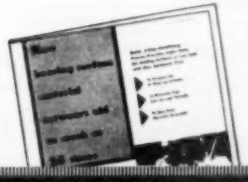


Fits restored—no re-machining

Press fit in electric motor end bell is frequently lost through wear. Welding is impractical here, too, because of warpage. But a few thousandths of Sprabond Wire on the I.D. builds a press fit so that even minimum grinding is often unnecessary. Savings per end bell—about $30.00.

Some other money-saving applications for the Sprabond Wire process

Cracked blocks and castings — flat surfaces — molds, patterns, match plates — sand holes thin sections — lathe ways—inside diameters — gas holes.



FREE BULLETIN Metco Bulletin 57B describes the advantages of the Sprabond Wire metallizing process in detail. Micro-photograph of Sprabond Wire coating on steel shows how it works. Use the coupon to send for your free copy today. No obligation, of course.

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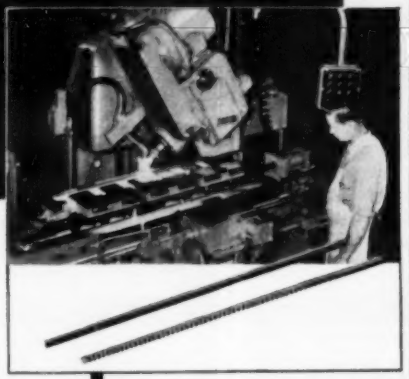

Here is another interesting and profitable application of Sundstrand Magnetic Chucks.

In this case the Chucks are used in a Sundstrand Automatic indexing fixture for holding a variety of sizes and types of broaching tools.

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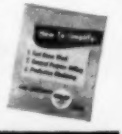

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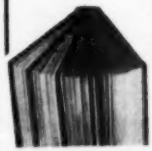

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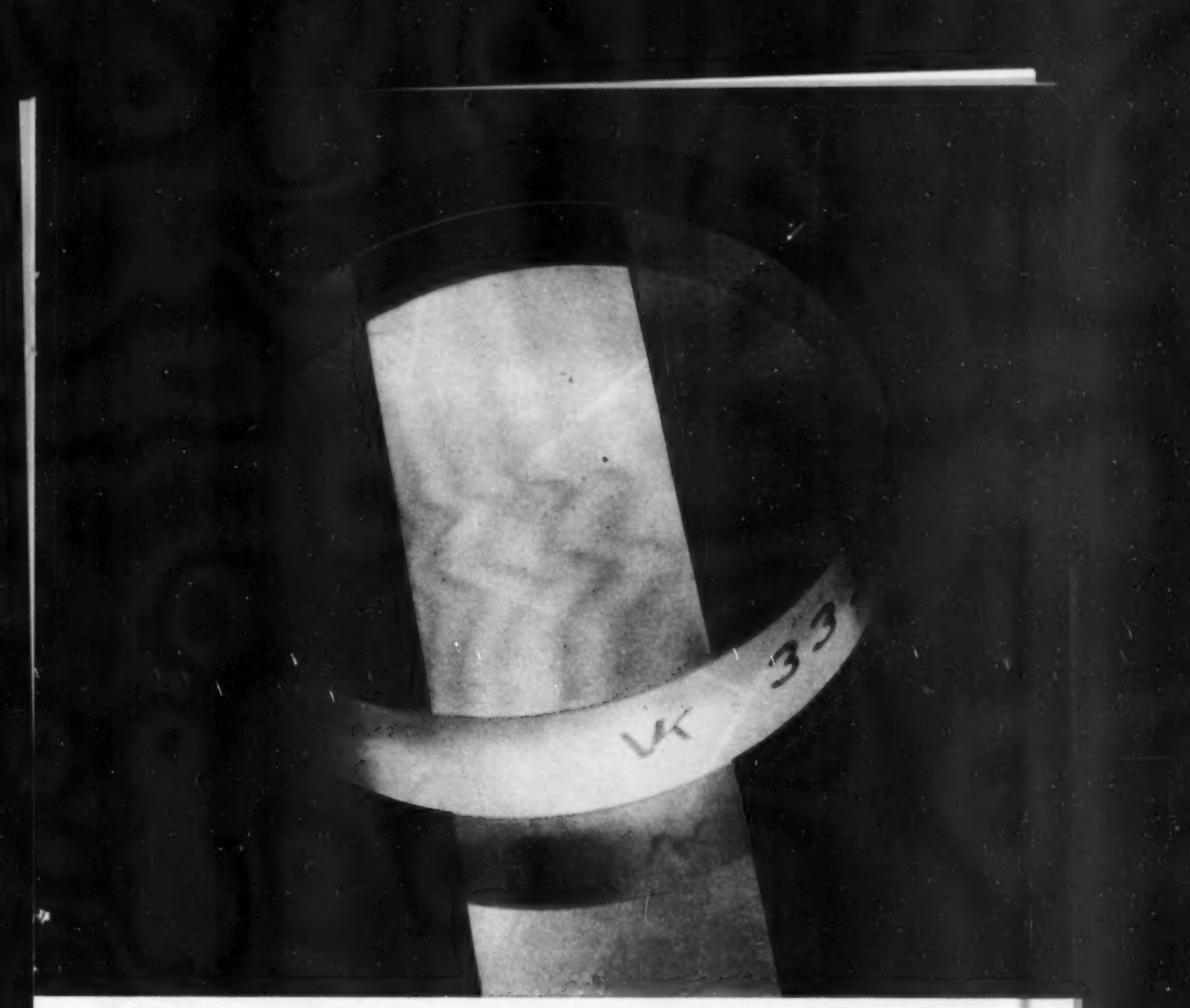

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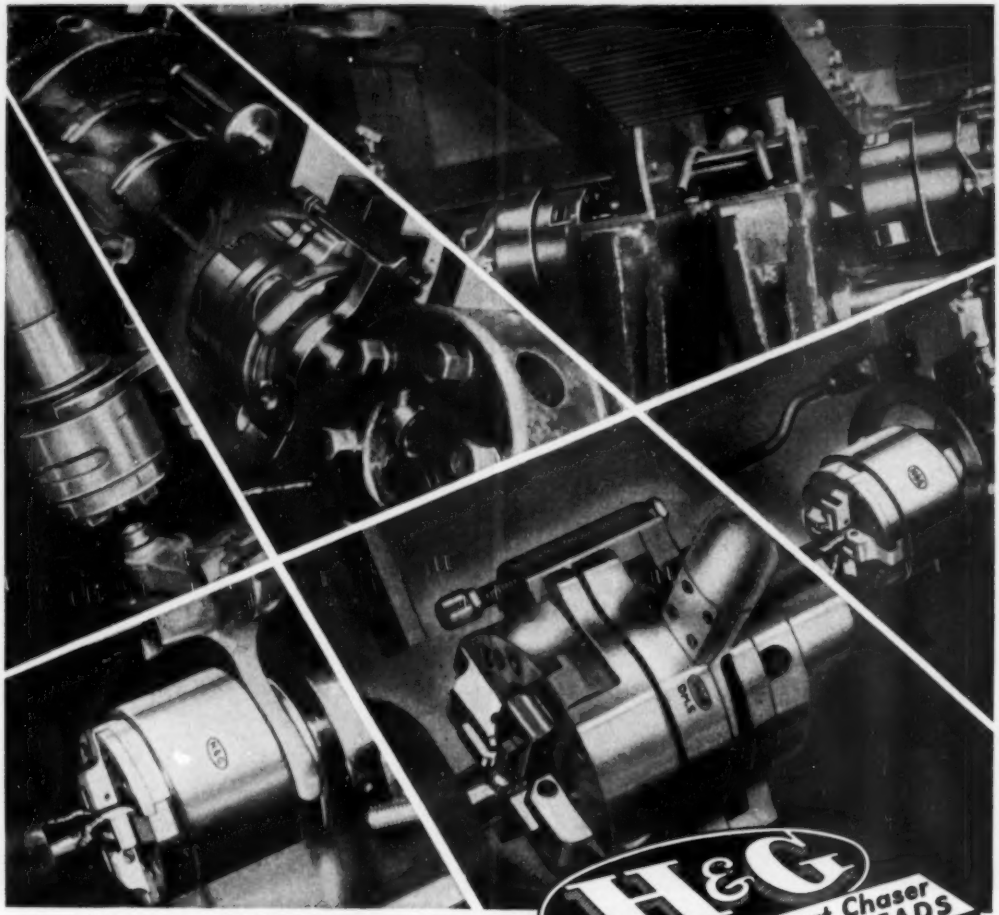

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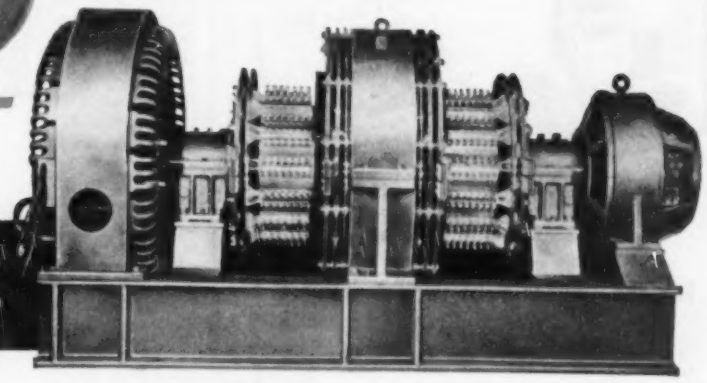

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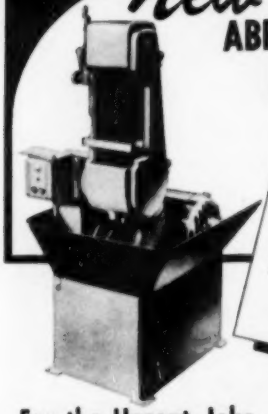
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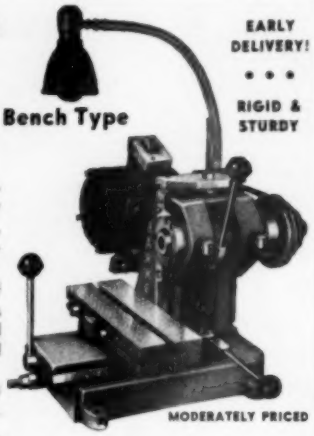

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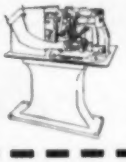

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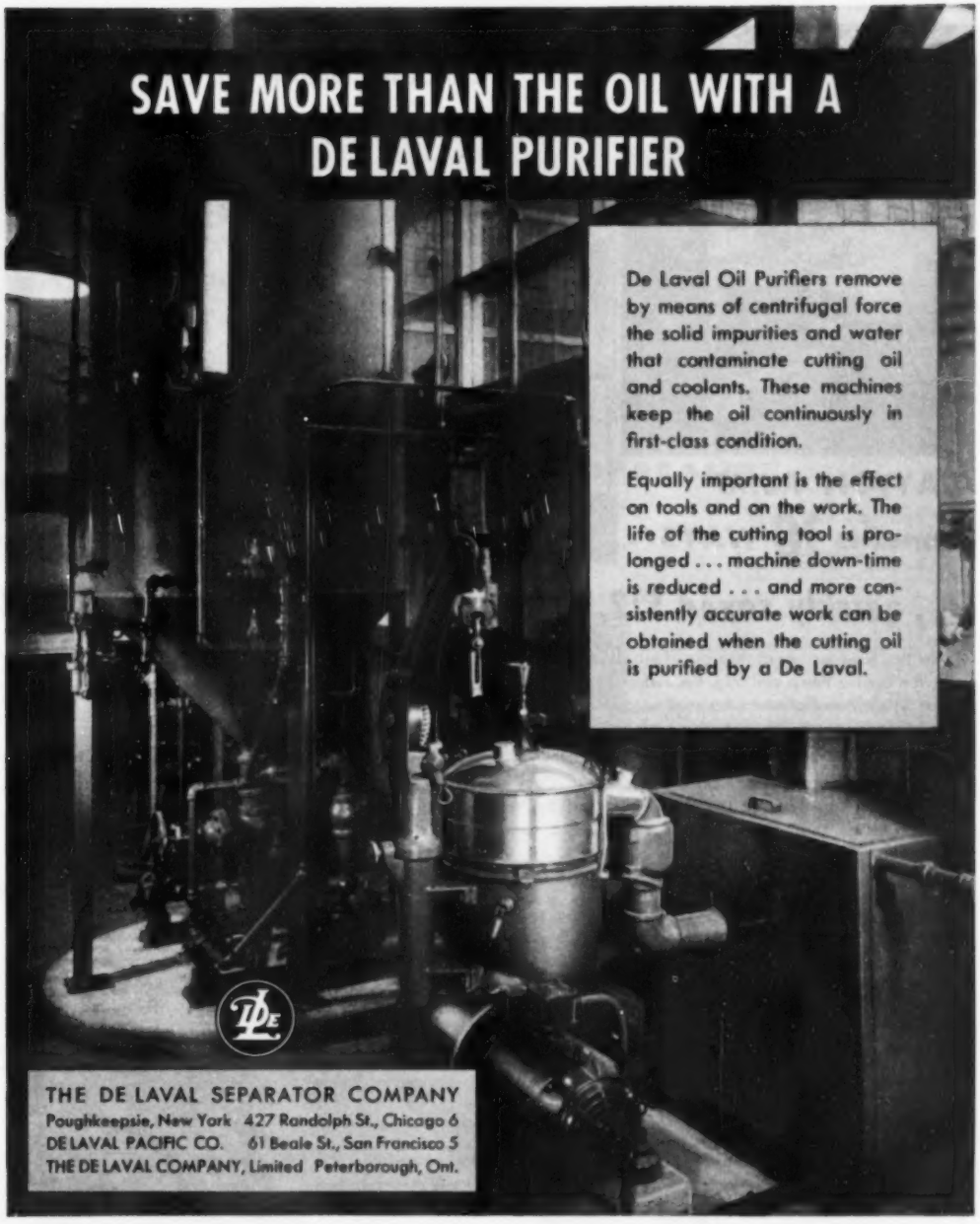

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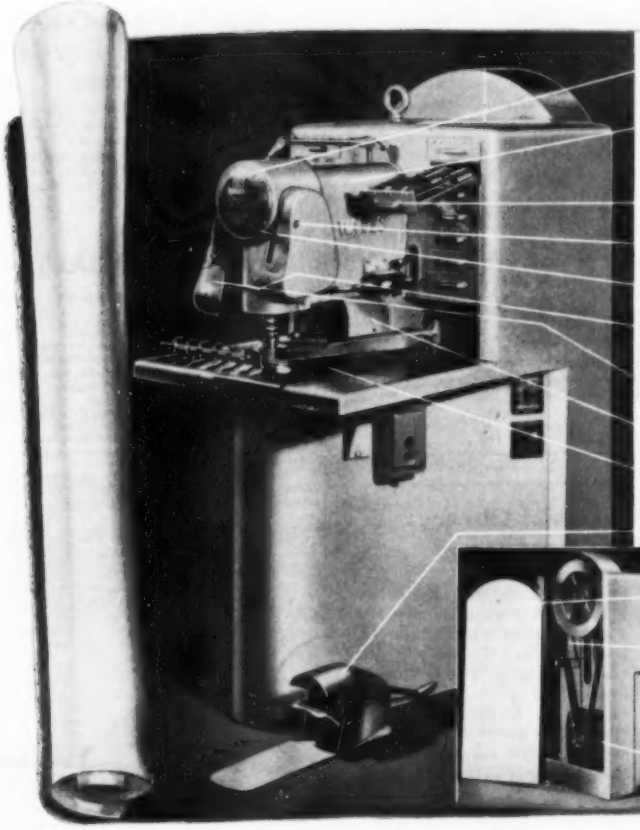

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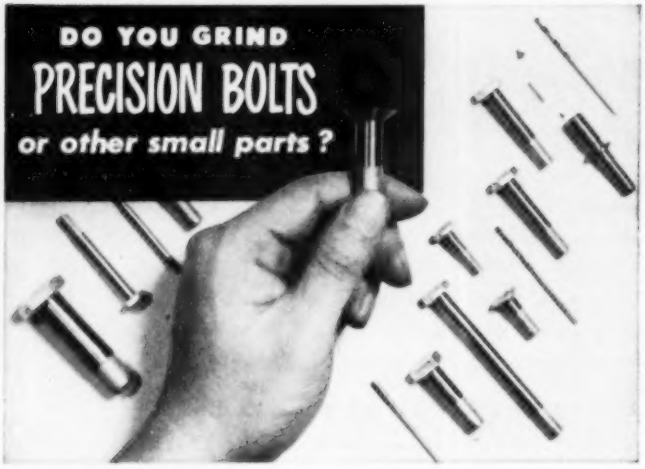

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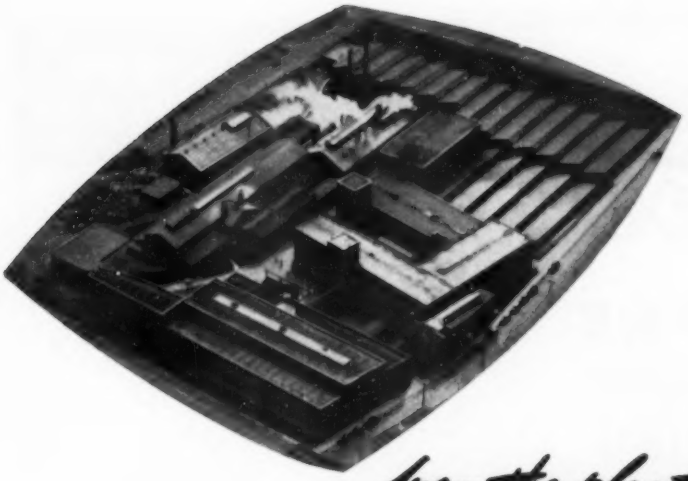
DON'T underestimate the effect of an unsound sales budget on production efficiency. Inaccurate forecasts mean fluctuating schedules, a changing work force, and low worker morale.

ARE you lugging materials to and from a machine for a minor operation that should be done where the material is? Check facing to length, centering, cut off, plain grinding. If volume is large, it may be cheaper to move the machine once and for all rather than moving the material continuously.



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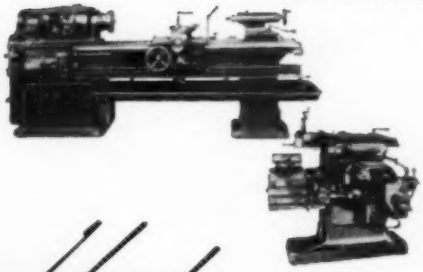

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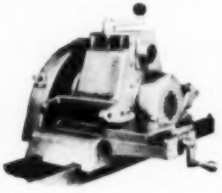
MODERN *Hendey* precision engine lathes and shapers

CUT faster with STONE High Speed CUTTING MACHINES

For production cutting of ferrous and non-ferrous metals at the rate of 4 seconds per square inch.

MODEL M-16

A floor model, 2½" x 4" equipped with full 5 h. p. geared-in-head motor engineered with positive drive, will cut all ferrous and non-ferrous solids up to 2½"—pipe and structurals up to 4". Can be furnished equipped for wet cutting.



MODEL SS-20

Operates on guided rails for cutting larger structural steel, plate, sheet, with cuts up to 10 feet in length. Cuts wet or dry.

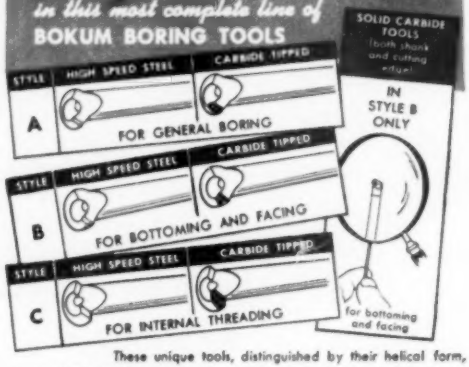
MODEL M-14

32" x 34" Bench Model. This mighty little brute, with full 3½ h. p. geared-in-head motor engineered with positive drive, will cut all ferrous and non-ferrous solids up to 2"—pipe and structurals up to 2½". Two models—straight cut-off and swivel head for angle cutting to 45°. Legs available.

BOOTH No. 447
1952 ASTE EXPOSITION

STONE MACHINERY CO., INC.
Fayette St. Manlius, N. Y.

You'll find the answer to practically every boring problem right here *in this most complete line of* **BOKUM BORING TOOLS**



These unique tools, distinguished by their helical form, are available in high speed steel, carbide-tipped and solid carbide in three styles: A (for general boring), B (for bottoming and facing) and C (for internal threading)—in a wide range of sizes from ⅛" dia. up.

Bokum is always ready to help you with your boring problems.

In addition, there are many accessories here to make applications of Bokum Boring Tools most efficient.

Send for catalog sheets for detailed information about these various tools.

See our Booth No. 121 at ASTE Show

BOKUM TOOL CO.
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HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

MODEL D-1 DIAL TYPE
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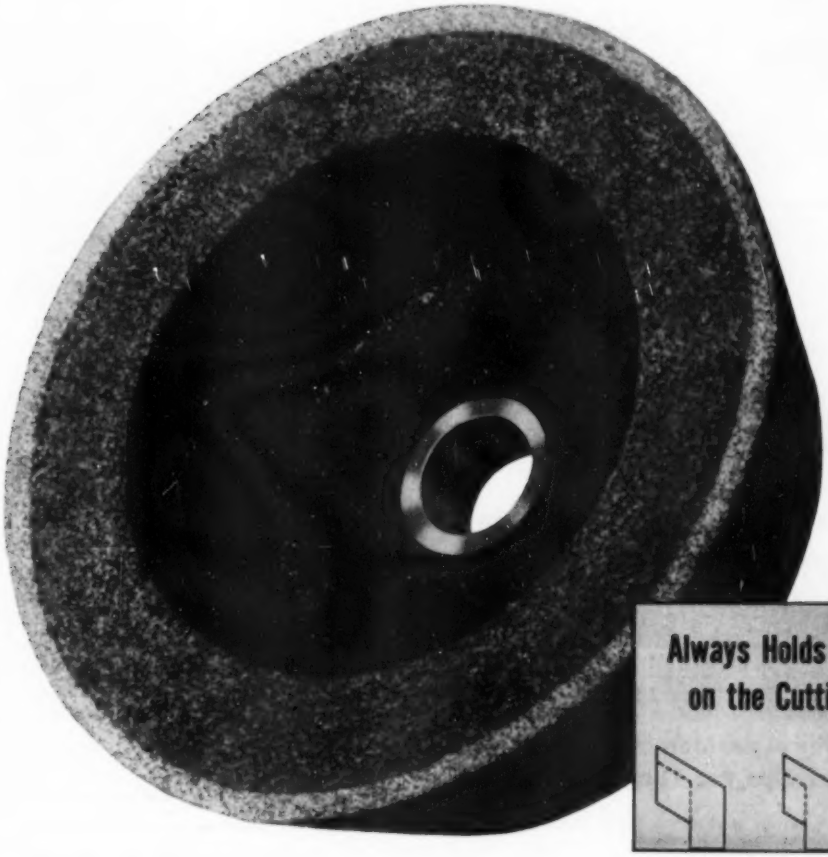
TELEPHONE: JAMAICA 6-4090

How U. S. Rubber improved cup wheels



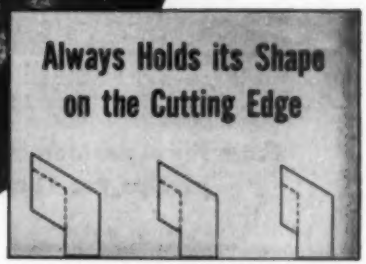


Diagram shows how the grinding face wears down evenly and the outer cutting edge remains sharp.

"U.S." technicians put an encircling rim, extra-tough and wear-resistant, around the free-cutting face of this Royalite® Hard-Shell Cup Wheel. As a result, the cutting edge does not become rounded. Hard-to-reach corners can be accurately ground because the edge does not break down. This free-cutting resinoid cup wheel retains its "true" shape throughout its entire service life.

Over 89 years' experience in the abrasive industry enables United States Rubber Company to solve all types of grinding problems. "U.S." engineers are always available for consultation. Write to address below.

PRODUCT OF U.S. RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

"PIGS IS PIGS" does not apply to GRINDERS!

There are two general types of Grinders (we make both)—the familiar direct drive with motor on top of pedestal and wheels directly on shaft, which is perfectly satisfactory for numerous applications.

But for highest production and lowest wheel cost, the HISEY TexDrive Grinder is a must. Consider the facts (1) wheels must operate at correct speed for quickest metal removal; (2) under speeded wheels wear faster; (3) A.C. Motor speeds are limited—900, 1200, 1800 and 3600 R.P.M.

The HISEY TexDrive Grinder has motor mounted on rear of pedestal and V-belt drive to spindle affords correct speed for any size or bond wheel—hence, highest production, longest wheel life.

The absence of the bulky motor between wheels also increases freedom of operation. Larger machines have multiple speeds to compensate for wheel wear.

If you have production grinding operations, it will pay you to investigate.

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CINCINNATI 8, OHIO
Division of The Cincinnati Electrical Tool Co.

Like Putting Money In The Bank!

GAY-LEE
"THINSAW"
CARBIDE TIPPED

Thin as .030"

You'll save time and rejects by using this new "Thinsaw" on production—precision slitting jobs.

- Eliminates run-outs even on deep cuts
- Thinnesses as low as .030"
- Tolerances can be held to .0001"
- Available in diameters up to 5"
- Circular tip seat gives extra braze strength
- Available in any grade carbide
- Cuts free of run-out to full depth
- Built without hub for close alignment in multiple cutting

Write today for catalog.

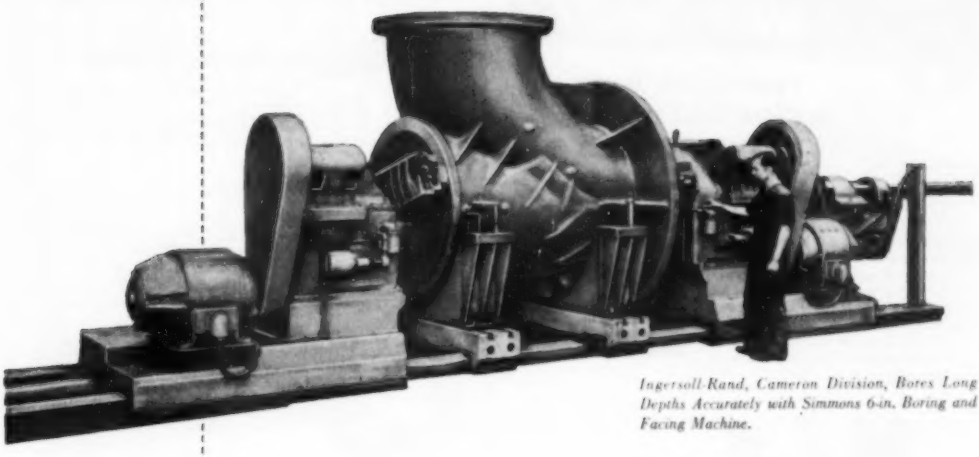
GAY-LEE COMPANY
CLAWSON • MICHIGAN

From the *American Machinist* Library of *Tips for Top Shop Men*

DON'T flaunt your greater income or privileges before your subordinates. No matter how much they like you, their resentment and envy will do you more harm than the flaunting does your ego good.

REMEMBER that human problems need careful study just as do engineering problems. Man is multi-motivated and one prescription won't cure all his ills.

BE suspicious of any figures you hear, and of most of those you see. If they don't correspond immediately to your previous experience, check 'em before you quote or use 'em. The urge to make numbers bigger, or smaller than anything previously reported is overpowering to some people; don't be victimized.



Ingersoll-Rand, Cameron Division, Bores Long Depths Accurately with Simmons 6-in. Boring and Facing Machine.

Have you a similar deep boring job?

Precision boring and facing of large castings is an important step in manufacturing centrifugal mixed-flow pumps. Speed and accuracy are prime requirements: that's why you find a Simmons 6-in. Bar Horizontal Boring and Facing Machine doing the job at Ingersoll-Rand Company.

Study these operating advantages:

1. **Automatic, continuous-feed facing head permits high-speed facing with carbide tools.**
2. **Hydraulic feed to entire head in addition to normal bar feed.**
3. **Boring head fed to and from work reduces overhang of boring bar to a minimum—resulting in greater accuracy.**
4. **A range of bar speeds between 3 and 200 rpm and bar feeds from 0.0005 in. to 0.500 in. per revolution can be furnished with this machine.**
5. **Unit type construction enables basic boring and facing unit to be adapted by Simmons to your special requirements.**

The Simmons 6-in. Bar Horizontal Boring and Facing Machine is ruggedly built, and offers precision performance. The motor drive (up to 50 h.p.) handles the largest boring jobs with ease. Precision anti-friction bearings and alloy-steel gearing are used throughout. Standard bar length is 17 ft., travel in one setting is 72 in. Bed lengths and widths can be supplied to meet your needs.

If you manufacture diesel engines, refrigerator machinery, large turbines or similar heavy equipment requiring deep cylinder boring, you will appreciate the speed and accuracy of this machine. Simmons engineers will work with you in adapting it to your specific needs. Write for details.

SIMMONS MACHINE TOOL CORPORATION

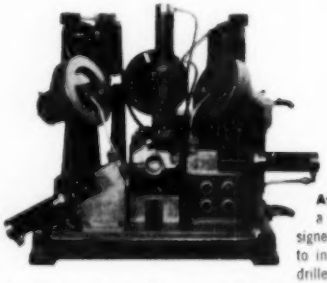
1759 NORTH BROADWAY, ALBANY 1, N. Y.

DON'T HANDCUFF Valuable MANPOWER!

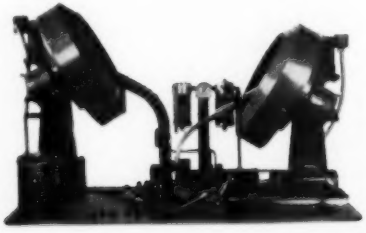
FREE IT FOR MORE IMPORTANT WORK— BY USING

DPS *Motorized* **HOPPER UNITS**

Modern production demands the speed and accuracy of this great aid to SELECTIVE FEEDING. It makes slow, manual methods obsolete and releases "frozen" manpower for more productive work. D.P.S. Motorized Hopper Units select, orient and feed production parts of a wide variety to a given position for primary and secondary operations. They are readily adaptable to all types of standard production equipment and special machines that would otherwise require constant attention by an operator.



At left is illustrated a special machine designed and built by D.P.S. to insert lead balls into drilled holes in a carburetor body, showing how our selective feeding device eliminates the slow, tedious hand insertion of the balls. The operator simply places the carburetor body in the fixture and presses a foot valve, three lead balls being simultaneously pressed into position—time saving, 66⅔%.



Above—The problem in this application was to insert a pal nut into a deep drawn stamping, which served as a base for a lamp finial. A double selecting problem existed, both in the selection of the pal nut and the stamping. The hand operation required that the operator pick up the stamping, insert the nut partially by hand, and finish the pressing operation by use of a small hand press. The Hopper Unit as a motorized selective feeding device entirely eliminated the manual element and made it possible to provide a completely automatic machine that more than doubled the total previous output of five operators.

See Us at the A.S.T.E. Show, March, Chicago
BOOTH No. 140

DETROIT POWER SCREWDRIVER CO.

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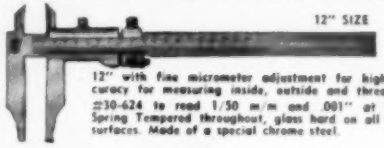
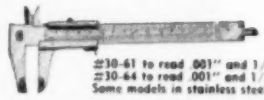
PRECISION VERNIER CALIPERS
made by the people who organized the best known measuring tool factory in the world.



12" SIZE

12" with fine micrometer adjustment for highest accuracy for measuring inside, outside and threads.
#30-624 to read 1/50 m/m and .001" at $31.00.
Spring Tempered throughout, glass hard on all wearing surfaces. Made of a special chrome steel.



6" SIZE

#30-61 to read .001" and 1/128" } at $14.00
#30-64 to read .001" and 1/20 m/m }
Some models in stainless steel at $16.50

For measuring outside, inside and depth special Chrome Steel, spring tempered throughout, glass hard on all wearing surfaces. The original cam lock is positive, releases with slightest pressure, works as smoothly as only **M Z B** knows how to make it.

MICROMETERS

M Z B Micrometers 1" size to read .0001" with hardened threads, stop nut and ratchet comparable to the best only $15.00

Made by the men who made precision tools famous with the "know how" and experience that produced hundreds of thousands of the finest calipers ever sold.

We are interested in representatives in various territories, regarding an agency or a dealership for **M Z B** fine measuring tools.

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COUPLING BOLTS
MILLED STUDS
CAP SCREWS
SET SCREWS

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LATHES
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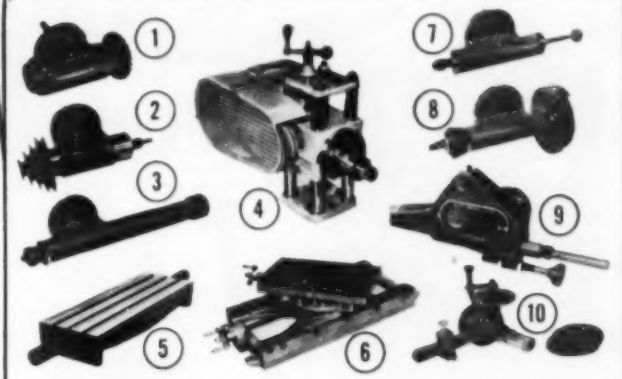
MILLS

OR USE INDEPENDENTLY



1. 90° Universal Milling Head
2. Hi-Speed Milling and Drilling Head
3. Deep-Hole Internal Grinder Head
4. Basic Milling Unit
5. Milling and Grinding Table
6. Universal Feed Table
7. Internal Grinder Head
8. External Grinder Head
9. Slotting and Keyseating Head
10. Geared Dividing Head

THREE SIZES

MODEL "C," ⅓ hp — 9" TO 13" LATHES
MODEL "B," ½ OR ¾ hp — 13" TO 18" LATHES
MODEL "M," 1 OR 1½ hp — 18" TO 72" LATHES

The Master attachment can be used profitably on many production operations. Mount it on your present equipment, lathes, turrets, mills, or use independently to perform additional operations in the same set-up. The basic milling unit with the above types of precision heads gives you facilities for milling, grinding, boring, drilling, indexing, slotting, and keyseating, both internal and external. Therefore, the Master with its full complement of equipment is an outstanding value for general purpose use in maintenance, repair, tool room, and experimental shops, as well as production, thus providing equipment that performs a full range of shop operations at a minimum investment. These improved models of Master attachments are outstanding in rigidity, capacity, and simplicity of set-up and operation and incorporate the latest features developed in our seventeen years of manufacturing this tool. Investigate this valuable shop tool. For the cost of one single-purpose machine, you can have several Master units producing. Prompt deliveries.

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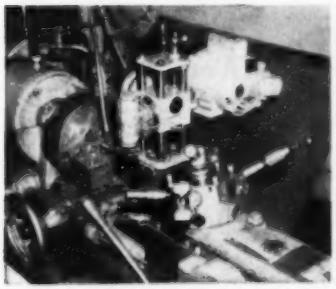
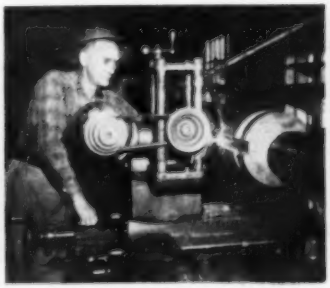
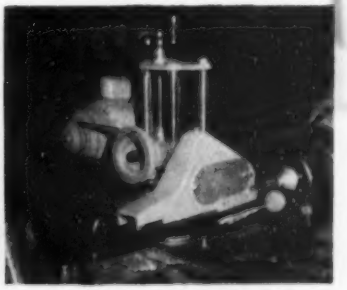


Milling on turret lathe completing part in one set-up



End Milling 2½" keyway in 9⅞" diameter shaft 22 ft. long



Master Slotting Head on lathe cutting internal taper keyway

FREE

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10" or 14"

TWIN WET OR WHEEL DRY

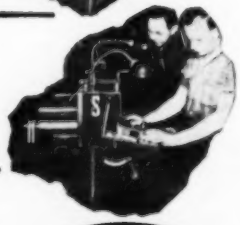
TOOL GRINDER

FOR CARBIDE, STELLITE OR HIGH SPEED STEEL TOOLS

one step from rough to finish grind

PATENT PENDING Type 10 TD

(Right) Mounting a new wheel in 5 minutes!



(Right) Operating view of 10 TD shows ample room to comfortably serve two operators. (Twin lights are optional.) Complete operator comfort when grinding wet. Absolutely no spray or splash.

UNIVERSAL PRECISION PROTRACTOR — TOOL GUIDE with DRESSER grind any size tool for any desired angle.

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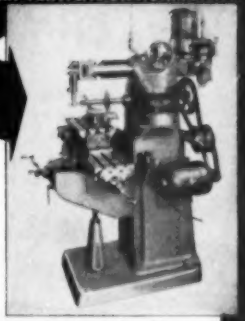

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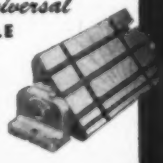

Tilts work 45° either direction. Quickly fastens on any milling machine. Speeds work. Cuts job costs.

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"QUEER DUCKS"—the men that don't fit the pattern—are also the men who don't think like the rest. They'll give you trouble, but they'll usually also give you ideas. Barnyard ducks conform readily to rules, but end up in a pot.

WATCH always for the jobs you *can't* do—well. Specialized equipment and specialized knowledge outside may be worth the extra cost in reduced scrap and headaches. Sometimes the price may be less too—and it costs nothing to get an estimate.

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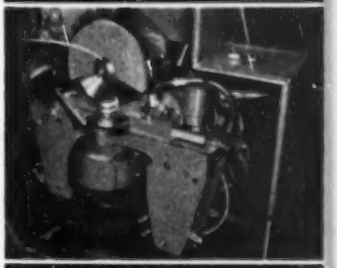
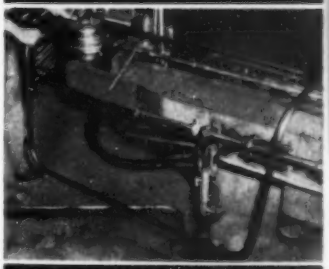
Tooling Set-Ups Engineered To Meet Your Needs

Here are five examples of bending applications illustrating how Pines machines are successfully employed to save time and cut costs on a wide range of bending work. As shown, different tooling setups are engineered and easily applied to handle a variety of production requirements. Hydraulic power, which is used on all Pines Benders, assures accurate, uniform production results and safe, dependable performance. Push-button controls and automatic operation assure high efficiency and production economy. There's a complete range of Pines Benders designed to handle light or extra heavy work, small lot, or high production runs. Call on Pines engineers when you need help with a bending problem. There is no obligation. Phone Aurora 2-7608.

1. MULTIPLE GROOVE DIE — on Pines Size 3 Automatic Bending Machine forms ten 7/16" x 83-1/2" steel rods simultaneously to a 22" radius for farm implements.



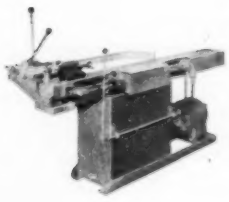
2. DOUBLE DIE AND CUT-OFF SETUP — on Pines Size 2/4 Automatic Bender. Produces 3/4" copper return bends to 7/8" c/l radii automatically, two pieces at a time.



3. TRIPLE RADIUS SETUP — on Pines Size 3/4 Automatic Bender handles three different radii and six 90-degree bends in 1-1/8" tubing in fast sequence. Increases truck seat frame output with less handling.

SEE EXHIBIT BOOTH 301 A.S.T.E. EXPOSITION

4. FORMING BLOWER HOUSINGS ON PINES ROTARY BENDER — bends irregular curve (radii of 5-17/32" to 7-3/4") in 5-1/2" width stock at a speed of 89 pieces per hour. Floating bronze pad acts as a wiper shoe, maintains uniform pressure, ensures smooth, wrinkle-free results.



5. PINES SEMI-AUTOMATIC BENDER — tooled for production-line bending of extruded aluminum automotive moldings. Simple setups and easy manual toggle clamping also provides unusual economy for variable short-run and maintenance work not adaptable to fully automatic equipment. Hydraulic power assures uniform results, safe operation.

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Double-End End Mills

IT'S THE TEETH THAT TELL

It's the "teeth" in Weldon End Mills that tell the story of more production and bigger profits on your jobs.

Weldon pioneered in producing *scientifically designed* teeth for end mills, a step over 25 years ago that opened the door to higher speeds, and faster feeds.

After lengthy experiment and study, the *tooth shape* and *spiral angle* on Weldon End Mills were radically altered from conventional styles. The result was a tooth that *allows chips to curl out without clogging* and *insures better performance* and *longer life* for the tool.

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VERSATILE! Checks set-ups and runout, *on the machine.* Reaches ID's and remote surfaces—with meter located for convenient reading. Ideal for surface-plate work. Thoroughly proven in shops, tool rooms and gage rooms.

SENSITIVE! Reads .0005" and .00005"—or .0001" and .00001"—per division, either side of zero, on continuous linear scales. Both scales always give same reading.

DEPENDABLE! *Frictionless movement* and *freedom from drift* assure CONSISTENT REPEAT READINGS.

FAST! Instantaneous meter response permits fast readings—dependable runout measurements.

FREE INDI-AC BULLETIN
Gives Full Details. Write for it!

AND ASK about the MICRO-AC Electronic Microcomparator (reads in millionths); PAR-AC Electronic Production Gage.

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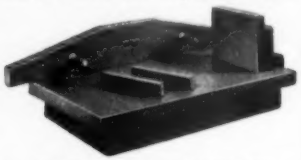
PRECISION INSPECTION EQUIPMENT

RAHN BLACK GRANITE
ACCURACY TO .00005"



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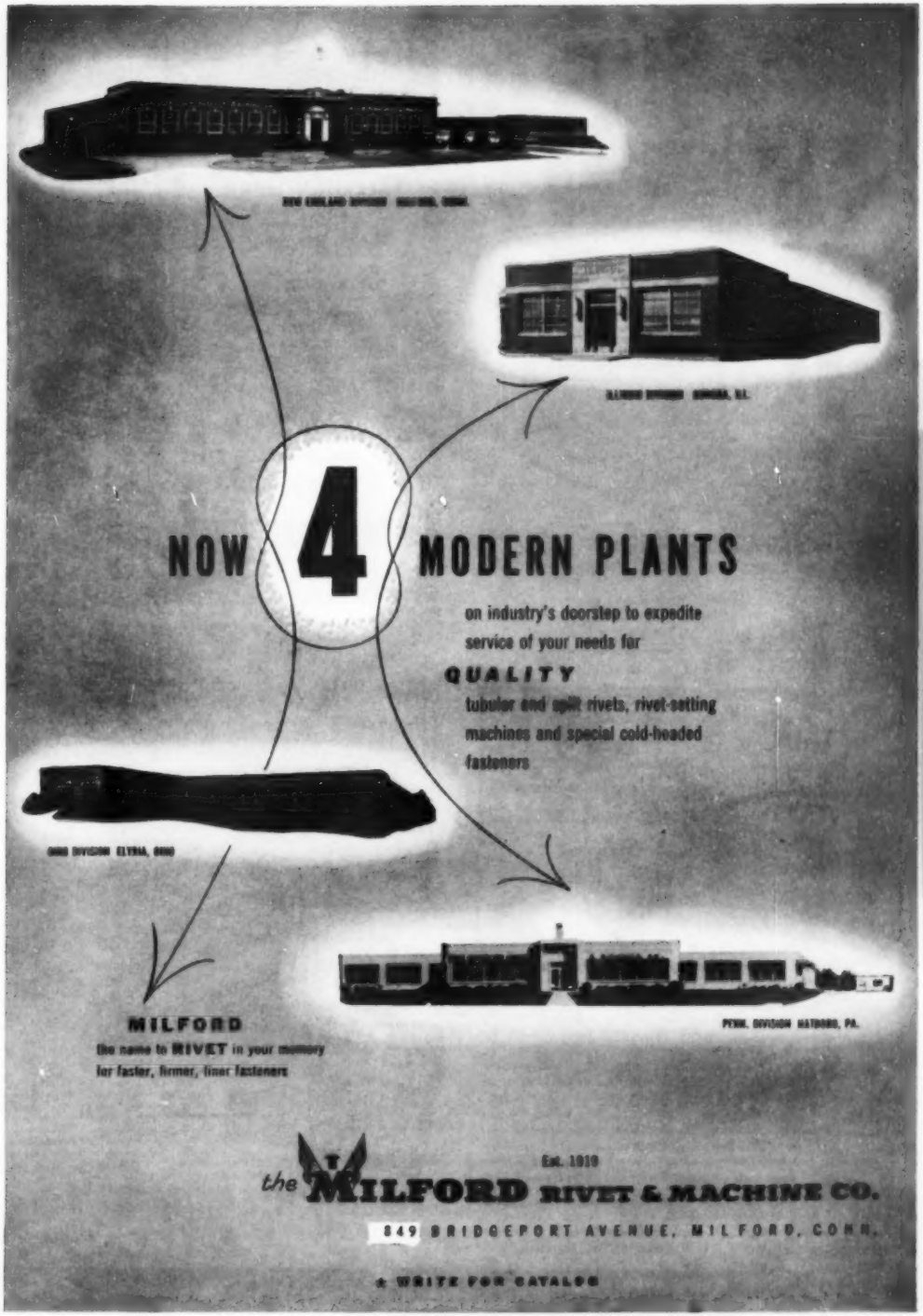
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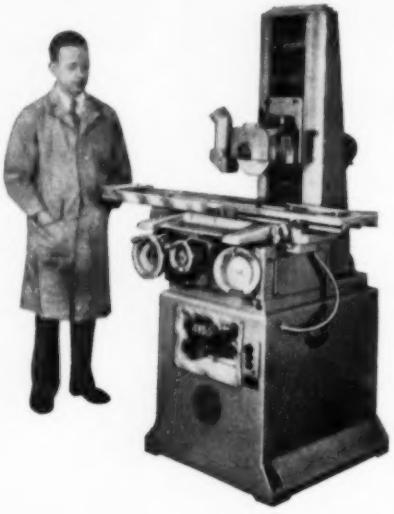
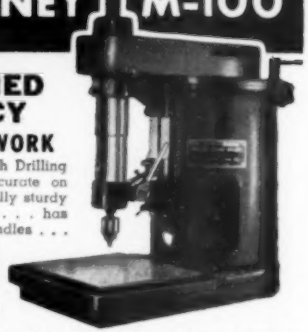


REID SURFACE GRINDER MODEL **618V**

WITH VARIABLE TABLE SPEED - 12 to 35 Feet Per Minute

REID BROTHERS COMPANY, INC.
BEVERLY - MASSACHUSETTS

SIGOURNEY M-100



MAINTAINED ACCURACY IN PRECISION WORK

The Sigourney M-100 Bench Drilling Machine is extremely accurate on precision jobs. It is unusually sturdy and rigid in construction . . . has hardened and ground spindles . . . and sealed ball bearings throughout. All moving parts are entirely closed for maximum operator safety. M-100 is built for long and steady service. This sturdily constructed bench drilling machine is available in 1, 2, 3 and 4 spindle models . . . speeds from 4,000 to 10,000 r.p.m.

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THE SIGOURNEY TOOL CO.
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Sole Sales Agents

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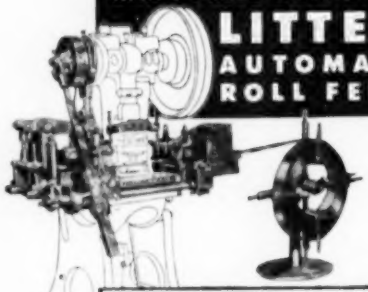
RAISE PRESS OUTPUT WITH LITTELL AUTOMATIC ROLL FEEDS



Press room output can often be multiplied five times by the simple addition of Littell Automatic Feeds to present equipment. The typical Littell Double Roll Feed shown here grips the stock on both sides of the die to assure maximum traction and feeding power. Stock is easier to start and finish in progressive die work. No hand feeding at either end of the stock. Rack and pinion drive provides the smoothness and the gradual acceleration and deceleration of feed rolls for a truly accurate feed. Standard Littell Automatic Feeds serve all types and sizes of presses, handle all standard widths and thicknesses of stock.

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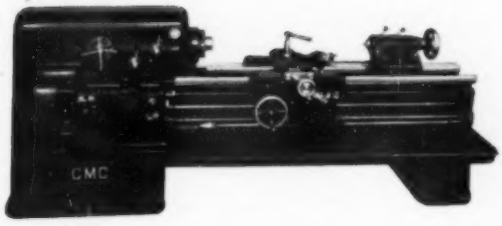
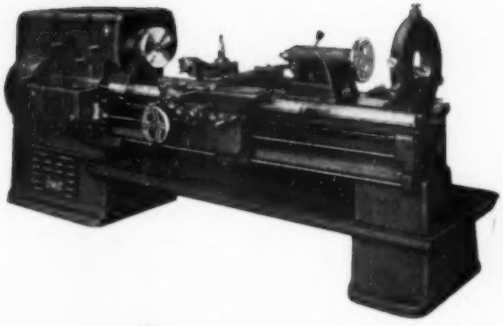


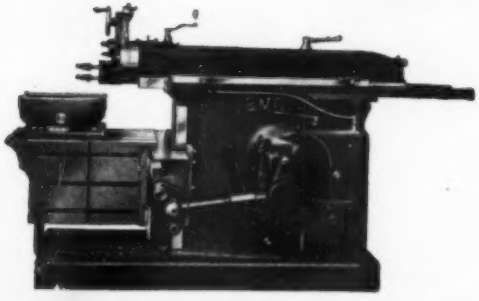
PRECISION TOOL ROOM LATHES
16" & 18" Swing

16 spindle speeds — Anti-friction bearings thruout—66 feed changes in the quick change gear box—motor in leg.



HEAVY DUTY "MASTER" LATHES
16"-18"-20"-22"-24"-26"-28"-30" Swing

16 spindle speeds — Anti-friction bearings thruout — 66 feed changes in the quick change gear box—motor in leg.



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18"-20"-26"-28"-32"-36" Stroke

8 speeds of V-Ram — Automatic down feed — Rapid power traverse to table — V-Belt motor drive — Bijur continuous forced feed lubrication.

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150-TON FOUR-COLUMN PRESS—Semi-automatic cycle. Advance at high speed, feed stroke starting at pre-set point in stroke and automatic reversal. Self-contained unit with reservoir, hydraulic pumps and control valves on top of press. Dual electric push buttons.

IT'S ALL A MATTER OF CONTROL

HANNIFIN HYDRAULIC PRESSES CAN BE EQUIPPED WITH THE *CONTROLS YOU NEED*

15-TON FORCING PRESS—With built-in hydraulic power unit and exclusive, patented Sensitive Pressure Control. Gap, 22" stroke, 21", reach, 10", table, 19" x 22" with U slot.

HANNIFIN'S NEW HYDRAULIC "HAN-D-PRESS"—For small part assembly operations. Available in 1-ton and 2-ton sizes with pressure adjustable. Stroke, 6"; reach, 6"; gap, 10". Speeds: (1 ton) 400 ipm, advance; 800 ipm, return. Dual manual controls standard.

35-TON OPEN GAP STRAIGHTENING PRESS—One of 17 standard straightening presses. For straightening crankshafts, axle shafts, line shafts and cylinder stock. Equipped with exclusive Sensitive Pressure Control and spring-mounted, work-holding fixture on 160" rails.

When you select a hydraulic press to do a certain job—*it's the control that's all-important.* Here Hannifin excels . . . for Hannifin Hydraulic Presses are supplied with many types of control.

One outstanding Hannifin development is patented Sensitive Pressure Control . . . standard equipment on Hannifin straightening and forcing presses. But Hannifin also offers conventional manual control, adjustable for maximum pressure, and a wide range of electric push button controls. Rapid advance followed by slow feed stroke, automatic reversal on time, pre-set pressure, or distance, all are available when needed. Ram speed control can be supplied as an optional extra feature with any of these controls, and cycling can be automatic or semi-automatic.

Chances are you can select the right press, and the type of control you need, directly from Hannifin's catalog . . . it lists more than 75 models, capacities from 1 ton to 150 tons. However, if your requirements are special, a Hannifin Field Engineer will analyze them, then recommend the exact control, or combination of controls, to do the job. Why not consult with him? Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill.

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Please send me Bulletin 130 on Hannifin Hydraulic Presses.

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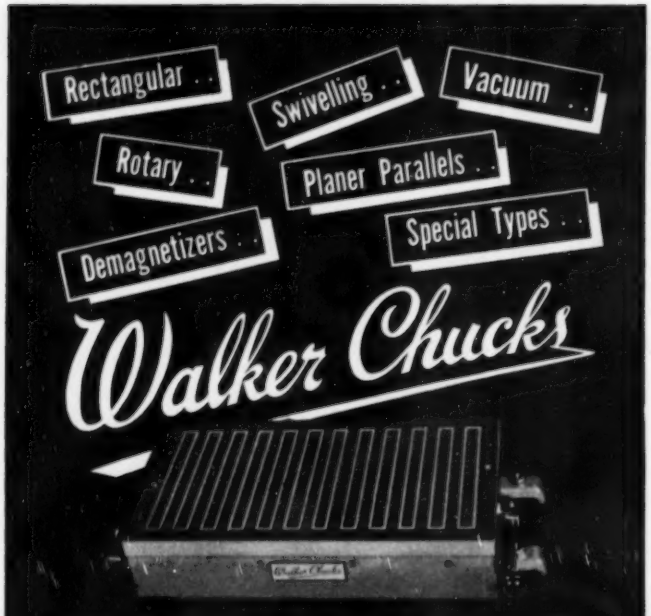

Walker Magnetic Chucks are designed for three absolute essentials . . . Polarization, Saturation and Balance. That is why **Walker** Chucks hold firmly at all points. **Walker Magnetic Chucks** are basic because: 1. Complete polarization of work piece. 2. Minimum saturation of chuck. 3. Essential magnetic balance of circuit. Over sixty years' broad experience in chuck design and manufacture is behind every **Walker** Chuck.

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Over 42 per cent of metalworking production equipment is now over ten years of age . . . 19 per cent of it was bought more than 20 years ago!

This means that there is more over-age and obsolete production equipment operating in metalworking shops now than in 1945, and the rate of obsolescence is growing.

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You can find out quickly by writing for a copy of the *American Machinist* Mid-Century Inventory of Metalworking Production Equipment. Here are all the facts on the age and number of 155 major types of production equipment, operating in 15 manufacturing divisions and 25 major production areas. Price: $2.00 per copy.

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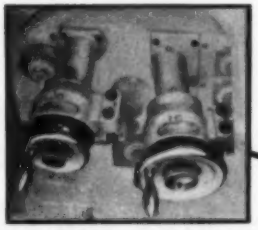
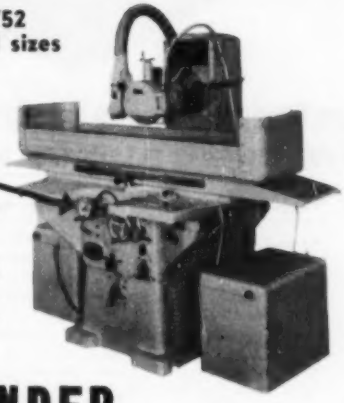
It's the "IN-FEED CONTROLS" that assure quick and precise GRINDING on a HIGH PRODUCTION basis

The BLOHM SURFACE GRINDER



Model HFS 6/52
other models and sizes available



HIGH GRINDING ACCURACY—up to .00005" vertically and .0005" on cross travel.

Constructed for wet or dry use, the work table is designed in such a manner that use either way can be instantaneous. Note the new "handy position" of the hand wheels for easy operation and positive control.

The MSO CYLINDRICAL GRINDER

Accuracy to .0001" with hand adjustment up to .00004"—

This is the latest high precision, high production grinding machine to become available for shops where advanced accuracy is desired.

It operates hydraulically by a single lever control enabling the operator to watch the working process.

Write for latest illustrated literature and prices.

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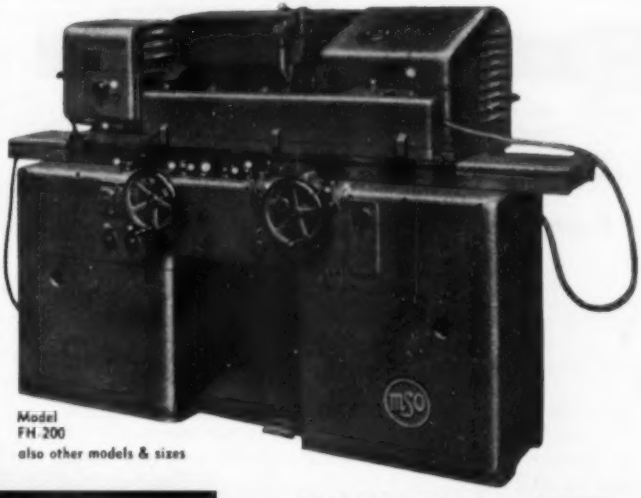

Model FH-200
also other models & sizes

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- - ALBERT KLINGELHOFER MACHINE TOOL CORP.
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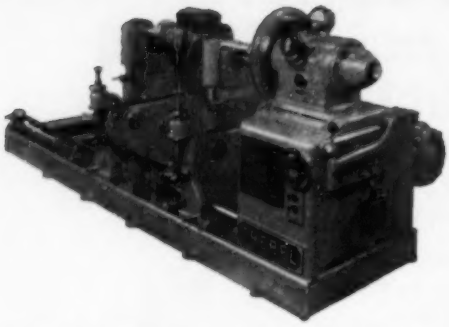
IMMEDIATE PRODUCTION SHORT CUT



New Dynamic Balancing Principle checks unbalance of rotating parts in Less than a Minute

No special skills are required to operate the NEW TREBEL DYNAMIC Balancing Machine. Just place the work in the machine, push the starter button, make two handwheel settings and get direct, accurate readings of the amount and location of unbalance—all in less than 60 seconds. That's why one TREBEL machine now balances as many 60-100 H. P. rotors in *one hour* as formerly required an entire shift with other methods.

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NEW RIB-LOCK

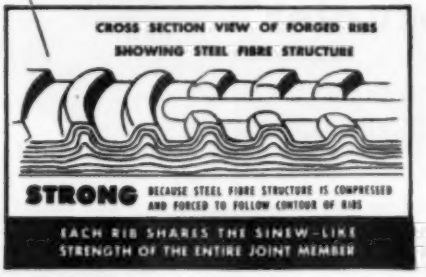
T. M. REG.

Pliers # 507-10

With *FORGED* rib-joint for added strength exactly where you need it.

FULL FORGED RIBS CAN *TAKE* IT!

AND HERE'S WHY:


CROSS SECTION VIEW OF FORGED RIBS
SHOWING STEEL FIBRE STRUCTURE
STRONG BECAUSE STEEL FIBRE STRUCTURE IS COMPRESSED AND FORCED TO FOLLOW CONTOUR OF RIBS
EACH RIB SHARES THE SINEW-LIKE STRENGTH OF THE ENTIRE JOINT MEMBER

Come See Us!
BOOTH 221
ASTE SHOW

Full forging of the rib joint is the secret of this new UTICA pliers. Forging makes the steel fibre structure follow the contours of the ribs as shown in the diagram above. Hence, each rib shares the sinew-like strength of the entire joint. There is no weak point, likely to break, with this method of manufacture.

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It pays to use quality tools — **U TI CA** — **and the world's best tools are made in U.S.A.**

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TAP KING

This lightweight, heavy duty tapping attachment was designed especially for difficult large hole tapping. Rugged, dependable, with a super-tap capacity of ⅜" to 1" in steel and up to 1⅛" in softer materials, the Tap King has been establishing production records. Many users report 50% production increases on large hole tap jobs and costly parts spoilage practically eliminated! And these are not isolated cases! Other users claim more **spectacular** daily production gains. Production men report amazing savings in parts spoilage and consistent, more accurate maintenance of uniform tap depth—even on large **blind hole** tapping jobs! Check these unique features:

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NEW! LARGER!
"TRU-GRIP" Tap Holder
Makes tapping easier close to walls or shoulders, eliminates "chewed" tap shanks. Lighter, smaller in diameter, it drives the tap by the square, holds it true by the round.

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March 17th to 21st

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Bores 5" holes in boiler plate in 80 seconds precise to .004". Finished holes can be bored from 1½" to 11⅞" diameter to a depth of 8" in one fast operation on present equipment. A truly heavy duty tool . . . not just another trepanning cutter. Removes stock in one piece, saving material.

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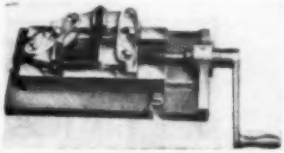

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The Vise that holds everything. Eliminates fixtures . . . quick adjustment for positive holding of round, elliptical, tapered, triangular or irregular shapes. Two moving jaws for quick centering of work. Available in four sizes for bench or machine work of all types.

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A universal tool for boring, facing, turning, recessing or undercutting . . . a single tool requiring a single set up. Features include: automatic feeds; end release and return, adjustable stop, adaptable to all standard machines. Highest precision; ideal for jig borers. Seven models for work up to 24" diameter.

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Here's speed, economy and lifetime service in this most efficient and economical soldering and general purpose bench furnace. This #22 furnace heats a pair of 12 lb. soldering coppers in 8 minutes. Can be used for melting lead, heating small tools, etc. Since 1911 BUZZER Soldering Furnaces have been the equipment of thousands of industrial plants, shops and schools.

Write today for catalog showing various types of furnaces, burners and other equipment.

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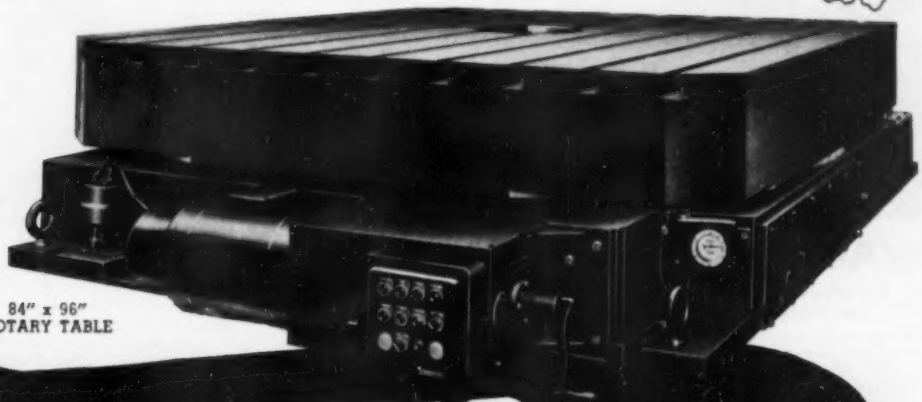
NEW **EXTRA HEAVY DUTY**

DESIGNED TO HOLD EXTRA HEAVY LOADS

OHIO STEP-UP PRODUCTION



84" x 96" ROTARY TABLE

The OHIO HEAVY DUTY *Revolving Table*

● BUILT IN HYDRAULIC CLAMPING AND RAISING DEVICE

Illustrated above is the 84" x 96" Special Heavy Duty OHIO REVOLVING TABLE, complete with built in Hydraulic Clamping and Raising device. A powerful **Hydraulic Lift** is utilized for raising the table top a few thousandths from its bearing, supported by a huge anti-friction thrust bearing, making revolving easy even with an enormous load of 150,000 pounds. The table is self contained and controlled by push button panel at the operators position. Power rapid traverse in either direction is built into the table and operated by a high torque motor with magnetic brake. Movement is controlled by momentary contact push button controls. Table is accurately graduated in ½ degrees and is furnished with a precision dial indicator and adjustable stops. Designed to improve and speed up production this heavy duty table is a modern development resulting from long experience and scientific study of machining problems and machine design.

STANDARD SPECIFICATIONS

Table Size	84 in. x 96 in.
Overall Height	27 inches
Weight - Approx.	37,500 lbs.
Load Capacity	150,000 lbs.
Size Tee Slots	1¼ inches

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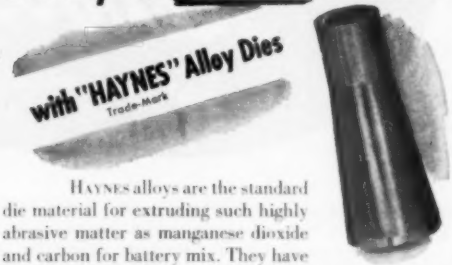

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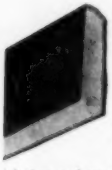

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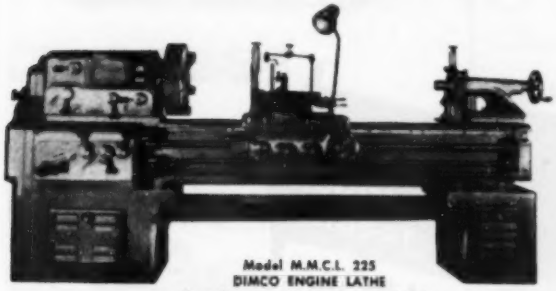

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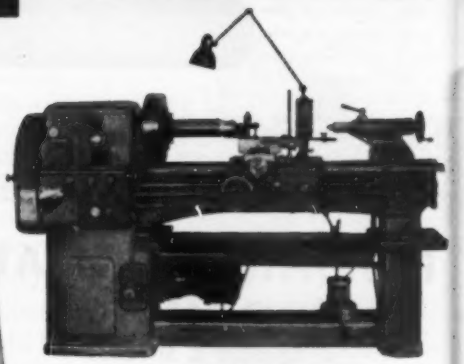

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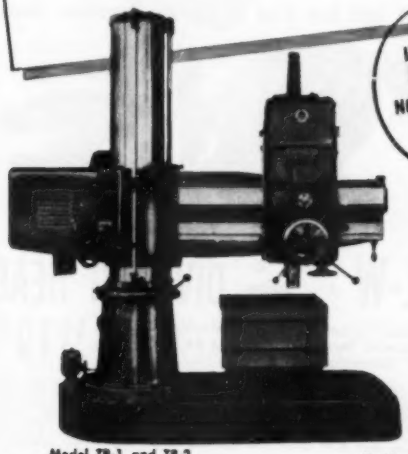

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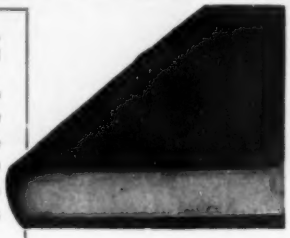

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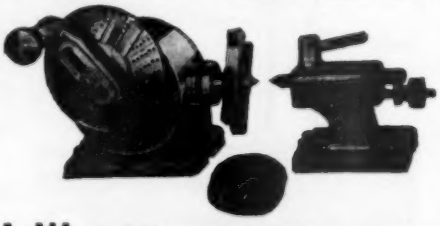

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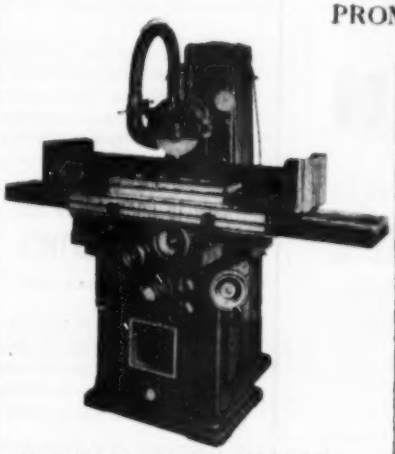

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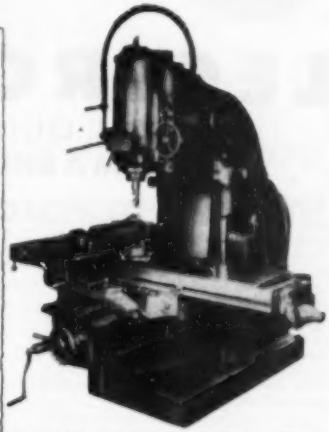

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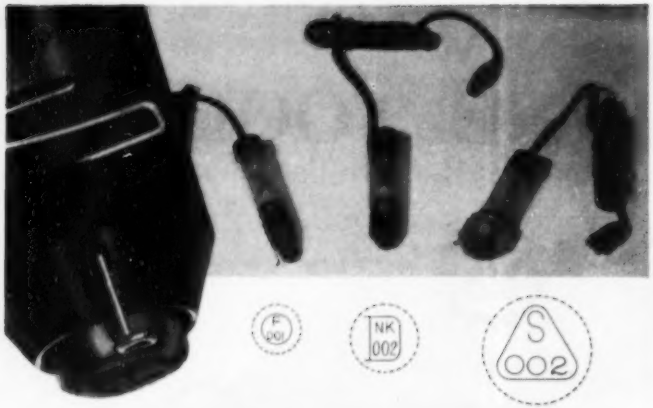

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TOCCO INDUCTION HEATING UNITS UP TO 50 K. W. IN ANY CONDITION

NATIONAL PRECISION CASTING CORP.
322 E. Berkley St., Clifton Heights, Penna.

WANTED

A Fellows Gear Shaper involute checker and Fellows red liner.

Must be modern, in excellent condition and reasonable.

When writing give age, serial number and electrical equipment.

W-3395, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

FOR SALE

Partial Listing of Machinery in Stock
FOR SALE

1—10' x 10 gauge Press Brake
2—7' x 10 gauge Press Brakes
1—10 Ton Henry & Wright Dieing Press. New Condition, Mfg. in 1945 all Electrical Equipment
1—Norton Angular Head Grinder. Model C. 10 x 36 Plain, Ser. #C-18255, Mfg. in 1942 All Electrical Equipment

HAYDEN MACHINERY
WALLINGFORD, CONN.
Telephone: 9-2370

FOR SALE
HORIZONTAL BORING MILL

1—Barrett floor type, 20 H.P., 220 V. DC motor drive—400-1600 RPM 6" Boring bar with 3¾" extension bar 36" from bar to table. Table 19'0" long. Cutters and heads to bore 8" to 36". Can be seen in operating condition.

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OSWEGO, N. Y.

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Model M-101 MOREY Rough Turning Gun Barrel Lathe, late type. Turning Length 10' 6" Dia. 1⅞" to 7", complete with 50 HP motor.

SAMUEL MACHINERY COMPANY
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Market 7-6100

WAR SURPLUS MACHINERY

WASHER—gear, axle, 2 slot.
POLISHERS—tumbler type.
RATIOMOTORS—Boston Gear.
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BAG SEALER—Ameco Rotary.
McCASKEY REGISTERS, tool records.

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MACHINERY COMPANY

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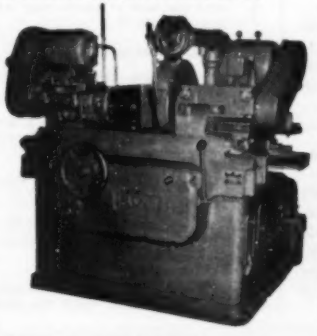
Every Item Guaranteed as Represented

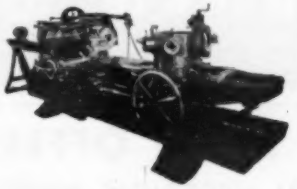
AUTOMATIC, #00 Brown & Sharpe, 5/16" cap.
AUTOMATIC, Cleveland Model #B-1½" Spl. Spdl.
AUTOMATIC, B & S #20, 1" Cap. M.D.
AUTOMATIC, National-Acme 5gls. Spdl. 4½".
BALANCER, Anderson Bros. 14"x66", Roto-Checker.
BORING MILL, 60" Betts Vert. 2 heads.
BORING MILL, Lunas #31 Horiz. 3" Bar.
BORING MILL, Giddings & L. #32 Horiz. 3½" Bar.
BORING MILL, Ryerson #11, Horiz. 5½" Bar.
BORING MILL, 24" Bullard M.D., V.T.L.
BARRELS, Tumbling Lapomatic, Baird.
BRAKE, Chicago #612 Hand Bending.
BRAKE, Chicago #185, 8'x5/16" cap. late.
BROACH #3 LaPointe Horiz. 50" Str.
COMPRESSOR, Ingersoll Rand ER-1, 10 HP, M.D.
CRANE, GET Shaw 10 tons, 56'0" span.
CRANE, Canton #8 Portable Gooseneck 3 ton cap.
CRANE, GET Ricker 2 tons 11'9" span.
CHIP WRINGER, Barrett #251, M.D., 10" dia.
CUTTER, 24" Grasso Automatic Paper, M.D.
RADIAL DRILL, 3'9" American, M.D.
RADIAL DRILL, 3'9" Mueller, M.D.
RADIAL DRILL, 4'x11" American, M.D.
RADIAL DRILL, 5'13" Cincinnati-Bickford
RADIAL DRIL, 6'10" American, M.D.
DRILL, Fondich 16", S.S. Power Feed, M.D.
DRILL, #2 Colburn H.D. #4 M.T., M.D.
DRILL, #121 Baker Auto. S.S. Cam Operated.
DRILL, Deep Hole, Avey-Draulic #2.
DRILL, Deep Hole, Pratt Whitney #2 Gun Barrel.
DRILL, Edlund #2B, 3 spdle. #2 M.T., 10".
DRILL, Cincinnati 21" with Tapping Attach.
DRILL, Naimo Multiple Spdle #12, #1 M.T.
DRILL PRESSES, Leland Gifford #1MS, 1, 2, 3, 4.
DRILL PRESS, #2MS Buffalo Forge single spindle.
DRILL, Barnes, 24" S.S., #4 M.T., 1¾" cap.
DRILL PRESS, #25 Foote-Burt S.S. 24", #M.T.
DRILL, #2MS Leland Gifford, 4 spindle, #2 M.T.
DEEPFREEZE Motor Products 40° below zero.
DEMAGNETIZER, SB-911 Magnaflux, late type.
FILING, #3 Thiil & Sawing, M.D.
FURNACE, Westinghouse Elec. 8 KW, 2100° F. cap.
FURNACE, Machler Steam Oven, Serial #3543.
GRINDER, Disc, Besly #205, 10" Dble. End.
GRINDER, Arter 16" Rotary Surface.
GRINDER, Cylindrical, Brown & Sharpe #2 Uni.
GRINDER, Oakley #3 Univ. Tool & Cutter.
GRINDER, Heald Rotary #25, M.D.
GRINDER, Hydraulic Contour Landis Cam 3"x40".
GRINDER, Cylindrical, Norton 10"x24", M.D.
GRINDER, Brown & Sharpe #4 Univ. 12"x60".
GRINDER, Cylindrical, Cinci. 6x18 Filmatic.
GRINDER, Thread, Jones & Lamson #TG-615.
GRINDER, Landis Crankshaft 10x32 Hydraulic, M.D.
GRINDER, Brown & Sharpe #2 Auto. Horiz. Surface
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, Pratt & Whitney 14x36 Vert. Surface.
GRINDER, Pratt & Whitney 22"x84" Vert. Surface.
GRINDER, Greenfield #12 Int. Hydromatic.
GRINDER, #31 Oliver Auto. M.D. Drillpolisher.
GRINDER, #33 Abrasive Vert. Auto. Surface.



LANDIS 6 x 18 Hyd. Cyl. Grinder, Type C. Serial #29196.

GRINDER, #22 Heald Horiz. Rotary Surface.
GRINDER, Diamond Snagging 10 HP, 24"x4½".
GRINDER, Norton 6x18 Vert. Surface, Hyd. Late.
GRINDER, #1 Moore Jig M.D. Late.
GRINDER, #00 & #70 Heald Internal.
GRINDER, Landis 8"x18" Hyd. Cyl. late type.
GRINDER, Sellers Type #1A Tool, 24" wheel.
GRINDER, Porter-Cable #B-3, 10" Belt, M.D.
GEAR HOBBER, #3 Barber Colman, M.D.
GEAR HOBBER, B & S #34 6gur, 18" dia.
GEAR SHAPER, Fellows #6 High Speed.
GEAR SHAPER, Fellows #7 High Speed.
HAMMER, Rochester Hispeed, all sizes M.D.
HAMMER, Bradley 2000# Rubber Cushioned Helve.
HEADER, Manville #1 S.S.S.D. Cold, 5/16".
AIR MOTOR HOIST, Ingersoll Rand 2000# cap.
ELECTRIC HOISTS, 500-4000 lbs. Whiting, NEW.
KEYSEATER, #5 Mitts & Merrill Giant, M.D.
KEYSEATER, #6 Mitts & Merrill Giant, M.D.
LAPPER, 25" Norton Vert., M.D., late type.

DISC GRINDER
Osterheim 32" Wheel Diameter Disc Grinder. 40 HP. TEFC 3/60/440 spindle motor drive. 24" capacity.



#3A WARNER & SWASEY Turret Lathe, M.D., Bar Feed.

LATHE, La-Swing 8"x18", M.D., A.C.
LATHE, Porter-Cable 9"x15" Geared Head Prod.
LATHE, Hendey 12"x5", G.C.G. Taper Attach.
LATHE, LeBlond 14"x5', G.C.G.
LATHE, Hendey 14"x8' G.C.G. Taper Attach.
LATHE, Lodge & Shipley 16"x5', G.C.G., Grd. Hd.
LATHE, American 16"x6' G.C.G., Grd. Hd.
LATHE, Lehman 18"x7' G.C.G., M.D.
LATHE, Lodge & Shipley 18"x8', G.C.G., Gr. Hd.
LATHE, American 18"x10' G.C.G., Grd. Hd.
LATHE, South Bend 18/28"x8' Gap Bead, G.C.G.
LATHE, Hendey 20"x10' G.C.G., Taper Att.
LATHE, Reed-Prentice 20"x10' Grd. Hd.
LATHE, LeBlond 22"x10' G.C.G., M.D.
LATHE, Putnam 24/32"x12' G.C.G., M.D.
LATHE, LeBlond 24"x14' G.C.G., Grd. Hd.
LATHE, Lodge & Shipley 26"x14', G.C.G., M.D.
LATHE, McCabe 26/48"x16' Double Spindle Lathe.
LATHE, Bridgeford 27"x12' Geared Head, M.D.
LATHE, Bridgeford 32"x16' G.C.G., Grd. Hd.
LATHE, Pond 36"x100" Grd. Hd. With Equip.
LATHE, Sulky Dble. End #VMTS, Devine Bros.
LATHE, Turret #1 Bardons & Oliver Electric Head.
LATHE, Turret, #2 Simmons Vari Drive 220 V.
LATHE, Turret, #4 Warner & Swasey Univ. 1½".
LATHE, Turret, #6 Warner & Swasey Grd. Hd. Ram Type, Bar Feed, Motor in base.
LATHE, Turret #2 Cinci. Acme Univ. Geared Head.
LATHE, Turret, #3A Warner & Swasey Univ. M.D.
MILL, Nichols, Hand, Coolant, M.D. Late Type
MILL, #2 Pratt & Whitney Prod. Duplex, M.D.
MILL, 2A Brown & Sharpe Horiz. Univ., M.D.
MILL, #4B Brown & Sharpe H.D., Horiz. M.D.
MILL, #14 Garvin Plain Horiz., M.D.
MILL, #6T Brown & Sharpe Plain Horiz., M.D.
MILL, Cinc. Horiz. #3, #4, #5, High Power.
MILL, #3 Cinc. Univ. Horiz., M.D.
MILL, #8C Becker Vert. Die Sinker, M.D.
MILL, #1 Brown & Sharpe Plain Horiz., M.D.
MILL, #0-8 Cinc. Vert. & Horiz. Prod. Late.

#11 Ryerson Horizontal Drilling and Boring Machine, 5½" diam. spindle.

MULT-MILLER, U.S. Tool #MM-1-G, Auto. Prod.
MILL, #0 Vernon Hand Mill, M.D. Late
MILL, PLANER, Ingersoll 42x36x12, 4 heads.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILLING MACHINE, LeBlond #4, Horiz. Univ.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILLING, Brown & Sharpe #3 Horiz. Univ.
MILLING MACHINE, Van Norman #2 Duplex.
MILLING MACHINE, K & T #2B Horiz., M.D.
NIBLER, Gray Turret Type ¼"x24" cap.
NIBBLER, #2 Ronson Roller Die 9/16"x36" cap.
OZALID Model "F" Whiteprint Machine, Late.
THREADING, Staybolt Lansiter Millholland 1½".
THREAD MILLER, Leon Brodnor #40A Automatic.
THREAD MILLER, Pine-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, Late.
PLANER, Cincinnati 20"x30"x12" A.C., M.D.
PLANER, 48"x48"x12' Cleveland Openside.
POWER PRESS, Bliss #104 Open Back.
POWER PRESS, Bliss #3A S.S. Dble. Crank Grd. 45 tons, 4" stroke, 30"x26" Bed Area.
POWER PRESS—Bliss-Consolidated #153-S Straight Side Dble. Crank, 45 tons.
PRESS, #76½ Bliss S.S. 9½" Str., M.D.
PRESS, Robinson #5 O.B.I. 85 tons, M.D.
PRESS, Federal #2 O.B.I. Grd. 2" Str.
PRESS, Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRESS, Toledo 50½ S.S. 4½" cap. 8" str.
PRESS, Waterbury-Farrel High Speed 60 tons #3W.
PRESS, 60C Bliss Double Action, 3 cranks.
WHEEL PRESS, Cambria-Steel 40u tons cap. Hyd.
PRESS, Lucas 15 tons Power Arbor M.D.
PRESS, #60 Whitney Deep Thr. 24", foot.
PRESS, P2, P3 Ferracute M.D. Roll feed.
PANTOGRAPH, #1A Gorton M.D. Engraving.
PUNCH, Hecker Turret, 8 station, cap. 2½" hole.
PUNCH, H & J #2 6gle. Ind. 24" Thr. 1" thru 1".
PUNCH H & J #3 6gle end. 48" Thr. 2" thru 1½".
RIVET SETTER, ⅜" cap. Conn. Tubular Rivet.
ROLLS, #1 Buffalo Forge Vertical Bending, NEW.
ROLLS, #1 Buffalo Forge Wrapping.
ROUTER, #W240D, Onsrud, Electric H.D.
COLD SAW, Espen-Lucas #706, 48" dia. blade.
CUT-OFF SAW, Yates-American #M-90.
SAW, #302 Campbell Abrasive Cut-off.
SAW, #20-C Racine Shear Cut 6"x6" cap.
SAW, Band, Tannewitz &GH-36" High Speed.
SHAPER, 16" Pratt & Whitney Crank, M.D.
SHAPER, 32" Cinci. S.G., Motor driven.
SHAPER, Columbia 32" B.G. Crank.
SHAPER, Morton 36" Draw-Cut, 4-Speed.
SHAPER, G & E 24", high duty, bark geared, M.D.
SHEAR, Quickwork #-1 Rotary 60" Throat, 10 ga.
SHEAR, #8E Niagara M.D. 8'x3/16" cap.
SLOTTER, 12" New Haven Vertical, M.D.
SPRUE CUTTER, Milwaukee 36 tons, 2½" cap.
SURFACE PLATES & TABLES, all sizes.
TAPPER, #1 CAM Haskins, Motor Driven, Late.
TAPPER, #1 Bakewell (Warner & Swasey) Late.
WELDER, 300 KVA Federal, Projection.
WELDER, 75 KVA Federal, M.D., Spot.
WIRE STITCHER, Morrison and Acme, M.D.

OTHER 2000 MACHINE TOOLS AVAILABLE "IN STOCK"

HARVEY GOLDMAN PRESENTS

This Trade Mark Stands For:

- THE FINEST MACHINE TOOLS
- 3 GENERATIONS OF EXPERIENCE
- GUARANTEED SATISFACTION

CONSULT US WHEN YOU WANT THE BEST!

- AUTOMATICS
- BROACHES
- DRILLS
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- LATHES
- MILLS
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- PRESSES
- SHAPERS
- MISCELLANEOUS

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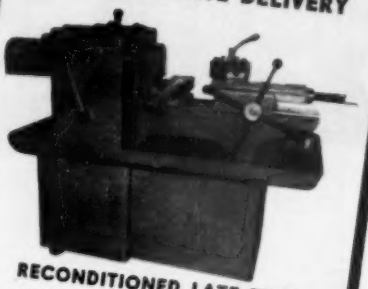

RECONDITIONED LATE TYPE

Model 601 W.D. Oster Turret Lathes (Several)

For Bar and Chucking Work

A high speed, simplified machine capable of handling a wide variety of turret lathe work as efficiently as many more complicated and higher priced machines, and with less skilled operators.

HARVEY GOLDMAN & CO.

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VICKERS INDUSTRIAL HYDRAULIC PUMPS

USED FOUR (4) MONTHS

Ideal for automatic operation of machine tools, conveyors, processing equipment and presses.

These pumps are self contained, piped and mounted on reservoir. Built 1947.

2—V104D Vickers Pumps cap. 10.3 G.P.M. at 1,000 P.S.I. at 1,200 RPM. Positive displacement, delivery in direct proportion to speed. H.P. required at full rating 7.5. Now driven by a 5 H.P., 1,200 RPM, F.284, Type L.T.E. Ball Bearing Motor.

2—V468D Double Capacity Vickers Pumps, large volume section—55 G.P.M. at 1,000 P.S.I. at 1,200 RPM. H.P. required for full rating 38.4. Small volume section—rating the same as V104D. This pump is now driven by a 15 H.P., 1160 R.P.M., F.365, Type CS. Ball Bearing Motor, 220-440V, 3 phase, 60 cycle.

1—VC128-A-6DD-2 Double Capacity Vickers Pump, large volume section—13.2 G.P.M. at 1,200 R.P.M. at 1,000 P.S.I. H.P. required 10.9. Small volume—rating the same as V104D. This pump is now driven by a 10 H.P., 1165 R.P.M. F.326, Type CS, Ball Bearing Motor, 220-440 V, 3 phase, 60 cycle.

1—VC128-D-6DD-2 Double Capacity Vickers Pump, large volume section—13.2 G.P.M. at 1200 R.P.M. at 1,000 P.S.I. H.P. required 10.9. Small volume section—rating same as V104D. This pump is now driven by a 10 H.P., 1140 R.P.M., F.254, type CS, sleeve Bearing Motor 220 V, 3 phase, 60 cycle.

LURIA BROTHERS & COMPANY, INC.

600 LINCOLN-LIBERTY BLDG., PHILA. 7, PA.

Att. Mr. Arnold Landesberg **Rittenhouse 6-7455**

MUST MOVE PROMPTLY FROM LOCAL CUSTOMER'S PLANT

BEMENT MILES 18" SLOTTER with 3" dia. spindle. M.D.

GOULD & EBERHARD 36" Gear Cutter M.D.

BROWN & SHARPE #5—48" Gear Cutter, M.D.

BINSEE MACHINERY COMPANY HORIZONTAL BORING MILL. Table 30"x64". Quantity of boring bars.

CINCINNATI 60"x48"x14' Planer. 4 heads. 1 extra side head on massive floor stand for open side work. M.D.

B & O #2 Turret Lathe 1" Cap. M.D.

FOOTE-BURT #25—24" Heavy duty Vert. Drill #5 M.T. Motorized.

GRINDERS—CYLINDRICAL. B & S #11. 7"x 32". Plain Grinder. Table swivels. Motorized with 4 motors.

LANDIS 10"x36" Plain, M.D. Also Planer type Grinder 16"x36".

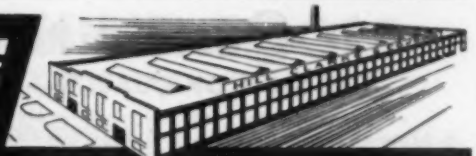
"BEMENT" 26" STROKE TRAVERSING HEAD SHAPER. 48" travel to ram. 2 tables. (PLANER SHAPER)

WE HAVE A LARGE STOCK FROM WHICH TO SELECT. TELL US WHAT YOU WANT.

THE OSBORNE & SEXTON MACHINERY CO.

P. O. Box 88 Columbus 16, Ohio

HILL-CLARKE MACHINERY COMPANY



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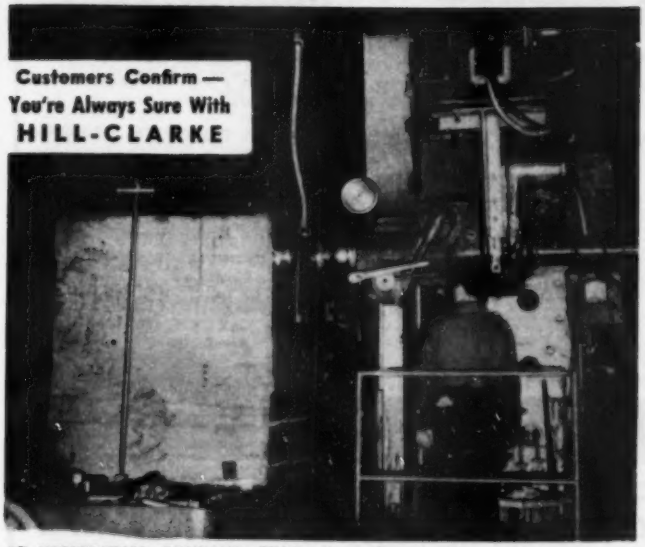

AT HEPPENSTALL COMPANY, Pittsburgh, a forged alloy steel hammer ram (weighing approx. 23,000 lbs.) is being machined. This Ingersoll face milling machine is one of a number purchased from Hill-Clarke. For economy and proven dependability, Heppenstall has been using Hill-Clarke for 14 years.

AUTOMATICS

⅞" G Model Gridley
1" 4 spdl. Greenlee
1-1/16" Model A Cleveland (1942)
1½" Foote Burt (1941)

DRILLS

1 Spdl—15" SW—No. 2 Avey, Cam Fd.
2 Spdl—24" Sw—No. 2 Aveymatic
6 Spdl—14" Sw—No. 2 LMS L.G. Hyd.
21" Sw Defiance—No. 4 Taper
D-31 Fox Multiple Drill

GEAR MACHINES

No. 12-H Gould & Eberhardt Hobber
11" Gleason Bevel Gear Generator
No. 6 Gleason Bevel Gear Tester ('42)
No. 64 Fellows Gear Shaper
No. 36-BM G & E 3 Spdl. Rougher
No. 65 Fellows—Cone Dr.

BORING MACHINES

Rockford—3¼" Bar
72" Niles—Hvy. Pattern

GRINDERS

6"x18" Norton Type C Plain (1943)
Hill-Clarke Norton Type Motor Driven Grinders
10"x36" centers
10"x50" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x72" centers
16"x120" centers
16"-40" gap x 120" centers
18"x96" centers
18"-30" Gap x 96" centers
20"x96" centers
24"-32" Gap x 144" centers
No. A-3—12" Arter Rotary Surf.
No. 25-A Heald Surface Grinder
5A Bryant Internal
5B Bryant Internal
No. 72-A-5 Heald Internal (1942)
No. 16-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 81 Heald Int. Cen.-Sizematic
No. 74 Heald Internal Centerless

LATHES

14"x6' Walcott Lathe
19"x8' LeBlond Hvy. Duty Lathe
20"x9' Chard Lathe
36"x18' Putnam Grd. Hd., M.D.
No. 4 Warner & Swasey Tur.-Bar Fd.
No. 6 Warner & Swasey Tur.-Bar Fd.
2¼"x24" Jones & Lamson
20"x8' Fay and Scott
18" Libby Tur. Lathe, M.D.
No. 1 Acme 20¼" Swing
No. 2H Libby—8¼" Hole in Spdl.

MILLING MACHINES

No. 08 Cincinnati Vert.
No. 3 Sundstrand Rigidmil
6"x168" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney (1942)

MISCELLANEOUS

24" Milwaukee Shaper
15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
No. 0 Bakewell Tapper
No. 200 Micro. Horiz. Hone, 1 Spdl.
No. H-2 Micro. Horiz. Hone, 2 Spdl.
Model 200—H5 Micro.—Horiz.—2 Spdl.
14' Niles-Bement-Pond Roll
Am. Chip Wringers (New) 3.3 to 12.6 bushel capacity
No. 6 R & K Straight-side Press, M.D.
42"-16 Ga. Economy Shear, M.D.
4-B Marvel Hack Saw
No. 5 Reynolds Power Screw Driver
75 Ton Hannifin Hyd. 4 post press
No. 175 G. T. Schmidt Marking Mach.
200 Ton Verson Hyd. Press
No. 44 Excello Carbide Tool Gdr.

PLANERS

36"x36"x12' Cincinnati, 2 hds.
36"x36"x12' Gray, 2 Hds.
42"x42"x10' Cincinnati 2 hds.
48"x36"x14' Gray, 2 hds.
48"x48"x12' Cincinnati; 2 hds.
48"x48"x12' Gray Maxi-Service
48"x60"x27' American, 4 hds.

FULL MONEY-BACK GUARANTEE

1. Hill-Clarke always give you an unconditional money-back guarantee.
2. All machines in stock.
3. You can see your machine run and tested under power in our plant before purchasing.
4. Complete and modern facilities plus experienced craftsmen for RE-MANUFACTURING machine tools in our 50,000 sq. ft. plant.
5. A responsible organization—with eighty-five years experience.

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Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY—THE MARK OF DEPENDABILITY

GEAR SHAPERS

No. 12 Fellows Gear Shaving Machine, m.d., late
No. 0 Fellows, belt drive
No. 7, 7A Fellows, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 01 Fellows, belted m.d.
No. 01A Fellows, m.d., latest type
No. 06B Fellows, m.d.
No. 615A Fellows, m.d., late type
No. 04A Fellows, m.d., latest
No. 045 Fellows, belt
No. 645A5 Fellows, m.d., late type
No. 72 Fellows, m.d., latest
No. 75 Fellows, m.d.

GEAR GRINDERS

6x20" Fitchburg Hydraulic Spline & Gear Grinder, m.d.
9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Spur & Helical
No. 7HS Lees-Bradner Spur & Helical, m.d.
No. 13LS Fellows Gear Lapper, m.d.
5611 Gear Grinding Machine, m.d., latest

GEAR HOBBING MACHINES

No. 12 Barber-Colman, single overarm, m.d.
No. 12 Barber-Colman, double overarm, m.d.
No. 14 Brown & Sharpe, m.d.
No. 44 Brown & Sharpe, Spur & Spiral, m.d.

GEAR CUTTERS

No. 50 Cross Universal Gear Chamfering Machine, m.d.
Gleason Spiral Bevel Gear Roughor, m.d.
3" Gleason Straight Bevel, m.d.
8" Gleason Straight Bevel, m.d.
11" Gleason Straight Bevel, m.d.
Cincinnati Gear Burnisher, m.d.
Cross Gear Tooth Rounder, m.d., 9" cap.
National Broach & Machine Co. Ring Gear Spooder, 12" cap.
No. 5—60" Brown & Sharpe, belted m.d.

GEAR TESTERS

No. 1 Brown & Sharpe Spur Gear Tester
12" cap. National Broach & Machine Co.
18" National Broach & Machine Co.

AUTOMOTIVE GRINDERS

Kwik-Way Model H Piston Turning & Grinding Machine, m.d., late
No. 70 Van Norman Automatic Piston Turning & Grinding Machine, m.d., late

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d.
Cincinnati Valve Seat Grinder, cap. ⅝" valve stems, m.d.

PLAIN CYLINDRICAL GRINDERS

6x18" Landis Plain Self-Contained, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x30" Cincinnati Hydraulic, m.d.
No. 10 Brown & Sharpe Self-Contained, m.d.
No. 11 Brown & Sharpe Self-Contained, m.d.
10x24" Landis Plain Self-Contained, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x48" Brown & Sharpe, belt
10x72" Landis, m.d.
10x72" Norton, motorized
12x36" Landis, m.d.
12x48" Modern, belted m.d.
12x96" Landis Plain Self-Contained, m.d.
14x16" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
14x72" Norton, motorized
20x120" Landis Self-Contained, m.d.

DISC GRINDERS

No. 2 Gardner, belted, m.d.
No. 1St Betty, m.d.
Hammond Disc Grinder, Model No. 600
Model V10 Hammond Belt Sander, m.d.
No. 4 Gardner Disc Grinder, m.d.
No. 20 Gardner Comb. Disc Grinder & Roll Sander, m.d.
7½ H.P. U.S. Elec. Tool Co. Disc Grinder, m.d., new

EMERY GRINDERS

3 H.P. Baldor Pedestal Type, 32M
3 H.P. U.S. Electrical Tool Co. Model 95
#516 Monmouth & Dixon Radial Emery Grinder, m.d., 5 H.P. motor
Hammond Model 4 Carbide Grinder

UNIVERSAL CYLINDRICAL GRINDERS

6x20" Fitchburg Hydraulic Splines & Gear Grinder, m.d., latest
No. 2—12x30" Brown & Sharpe, belt
12x30" Landis Hydraulic, m.d., late type
12x30" Cincinnati Self-Contained, m.d.
12x48" Cincinnati, arranged for spline grinding
12x48" Cincinnati, belted, m.d.
16x24" Cincinnati Self-Contained, m.d.

CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., 11-18" spindles
No. 55 Heald, m.d., 15-24" spindles
No. 75 Heald Airplane Cylinder Grinders, brand new, m.d., late type

WRITE FOR COMPLETE STOCK LIST

THE EASTERN MACHINERY COMPANY
1064 Tennessee Avenue, Cincinnati 29, Ohio — MElrose 1241 — CABLE ADDRESS EMCO

IN STOCK—INSPECTION INVITED

No. 00, No. 0, and No. 2 Brown & Sharpe Automatic Screw Machines and Turner Drives.

No. 2 Brown & Sharpe High Speed Automatic Screw Machine, 2400 spindle speed.

4½" Model A Cleveland Automatic Screw Machine, serial #34498.

1⅜" and 1⅝" Model A Cleveland Automatic Screw Machines, late.

1" and 1½" Greenlee Four Spindle Automatic Screw Machines, with tapping spindle.

24" Bullard Vertical Turret Lathe, New Era (2).

No. 3A and No. 4A Warner & Swasey Saddle Type Turret Lathe, M.D.

No. 4 Warner & Swasey 12 speed geared head Universal Turret Lathe, M.D.

No. 2G Morey Turret Lathes, late (3).

No. 4 Cincinnati Hi-Power Vertical Milling Machine.

No. 2 Cincinnati Centerless Grinder, serial #36A-13.

No. 1½ Abrasive 6"x18" Surface Grinder (1946).

6"x18" Norton Hydraulic Cylindrical Grinder (1943).

3" Gleason Bevel Gear Generator, late.

No. 3 and No. 12 Barber Colman long bed Gear Hobbers.

50 Ton Henry & Wright Dieing Machine, Reeves drive.

New Canedy-Otto Cincinnati Royal Drill Presses—16" (9)—18" (5).

Agents for Cincinnati Lathes and Canedy-Otto Drill Presses

MACHINE TOOLS

TELEPHONE TAylor 9-8200
LAKE MACHINERY COMPANY
942 WEST LAKE STREET • CHICAGO 7, ILLINOIS

MacDell Availables in Late Type Guaranteed Machine Tools

NATCO E5 Multi-drill Tapper 14 Sp. 1 MT 1941.

Cleveland 2½ Model A Single Spindle Automatic Mfg. 1943.

Pratt & Whitney 10" Gear Grinders Two Heads Mfg. 1941

Fellows 61A Gear Shapers Mfg. 1940.

Norton 23x72 High Swing Plain Cylindrical Grinder Mfg. 1943.

Landis 4H 4"x12" Plain Hydraulic Cylindrical Grinder Mfg. 1942.

Heald 25A 24" Rotary Surface Grinder Mfg. 1941.

Ohio Model P Production Mill 36" Table Travel Mfg. 1943.

No. 3 Plan-O-Mill Form and Thread Milling Machine Mfg. 1945.

Bakewell No. 1 Tapper (2) Mfg. 1941.

H 1 Micromatic Hone 1943.

MacDell Corp.

1042 W. Lake St. Chicago 7, Ill.

Walker No. 430-S Magnetic Chuck
Foote-Burt 2-way Horiz. Drill
Hardinge Model MD37 Bench Lathe
No. 202½ V & O Shell Trimmer

D. E. DONY MACHINERY CO.
47 Laureton Rd., Rochester 9, N. Y.

MACHINERY FOR SALE
ATTENTION EXPORTERS!

Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 Bhd Gould & Eberhardt Roughor, #7 Fellows Gear Shaper, #16 D. E. Whiton Machine. Write for full information.

FR-1035, AMERICAN MACHINIST
350 W. 42 St., New York 36, N. Y.

1941-1952 MACHINE TOOLS

IMMEDIATE DELIVERY — NO PRIORITIES NEEDED

CAM MILLERS

VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

CUTTER & TOOL GRINDERS

FELLOWS: Flat Top Helical Gear Cutter Grinder
IMPERIA: 10x20" Univ. Grinder (New)
OLIVER: #2 Face Mill Cutter Grinder
G&L: #3 Tool and Cutter Grinder
GLEASON: #12 Cutter Sharpener
OLIVER: 10" Template Tool Bit
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), automatic indexing

DRILLING MACHINES

ALLEN: #2 High Speed, 15" overhang
ROSA: Precision Drills (New)
ARCHDALE: Radials (New)
PRATT & WHITNEY: ⅛B x 50 Deep Hole Reaming Machine

GEAR CUTTING MACHINES

BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D. P. capacity
FELLOWS: #4 Enveloping Gear Cutter
FELLOWS: 61A Shaper, 18" dia.
FELLOWS: 64A Shaper, 18" dia.
FELLOWS: 72 Shaper, 7" dia.
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
GLEASON: 3" Straight Bevel Gear
SYKES: Gear Shaper 14" external, 20" internal (New)
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)

GEAR AND SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x 24" Hydr. Spur Gears and Splines
GLEASON: No. 17 Spiral, Zerol & Hypoid, capacity 23½ P.D.

GEAR FINISHERS & TESTERS

FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: No. 12-C Spacing Tester
GLEASON: No. 4 and No. 6 Bevel Gear Testers, Hand and Power
GLEASON: 3" Bevel Gear Tester
NATIONAL BROACH: SIC—12" Red Ring Tester

GRINDERS—CYLINDRICAL

BROWN & SHARPE No. 23, capacity 10"x48", plain
BROWN & SHARPE: No. 10 capacity 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, plain
LANDIS: 18"x32" Type "D" Crankpin, Hydraulic, for grinding crankshafts
LANDIS: 6x18" External
BERCO: External 11" to 22" swing & up to 110" centers (New)

Grinders—Cylindrical—Cont.

LIDKOPING: Centerless (New)
NORTON: 10"x36" plain, hydraulic
NORTON: 10"x18" 45° angle wheel
NORTON: Crankshaft, 23"x72"
VAN NORMAN: #666 Crankshaft Regrinder. 20"x48"

GRINDERS—GEAR & SPLINE

GEAR GRIND MACH.: GG-19, 10"x 24" Hydr. Spur Gears and Splines
GLEASON No. 17 Spiral, Zerol & Hypoid, capacity 23½ P.D.
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed

GRINDERS—INTERNAL

BRYANT: #5 Internal
BRYANT: No. 5Y Internal
BRYANT: 112 Universal. Hydraulic
BRYANT: 16C16 Hole, Hydraulic
HEALD: 72A3 Sizematic Centerless
LANDIS: Hydraulic, 8" stroke x 15"

GRINDERS—RADIUS

VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #639, capacity 7"
VAN NORMAN: #649, capacity 6" to 16" diameter
VAN NORMAN: #3½ Un. Radius

GRINDERS—SURFACE

ARTER: A-1—8" Rotary
HEALD: 8" Rotary
HEALD: No. 22 Rotary—12" Chuck
DIMCO: 8x24" Horiz. (New)
DIMCO: 8x24" Vert. (New)
CAMUT: 12x48" Vert. (New)

GRINDERS—THREAD

EXCELLO: #31 External, dia. 5"x18"

HONING MACHINES

BARNES: No. 306H Vertical, 24"
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia.

LAPPING MACHINES

FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
NORTON: No. 26 Hyprolaps, for flat work & cylindrical lapping
NORTON: 2Fx40" dia., for flat work

LATHES—PRODUCTION

BLOUNT: Polishing speed lathe 12" dia. x 48": centers
HENDEY: 16"x54" Toolroom
LODGE & SHIPLEY: #3A Duomatic, 25½" swing x 27" centers
MORANDO: 17x60" Toolroom (New)
PROGRESS: Geared head 16" to 30" swing (New)

Lathes—Production—Cont.

ERNAULT: Toolroom lathes, 11 to 20" swing (New)
ERNAULT: High production hydraulic duplicating and copying lathes (New)
DIMCO: Geared head 12" to 66" swing

LATHES—TURRET

HERBERT: Turret Lathes, all sizes (New)
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)
MOREY: #2G
DIMCO: 12" swing, hand feed (New)

MILLING MACHINES

CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables of 36" dia.
CINCINNATI: #0-8 Vertical Millers, Automatic Type
DIMCO: #1, 2, and 3 Univ. (New)
DIMCO: #3 Vertical (New)
KENT-OWENS: #1-8 Hydraulic Plain
RICE-BARTON: Duplex Spline
SUNDSTRAND: No. 0 Rigidmil
TAYLOR-FENN: M-80 Duplex Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

SAWS & CUT-OFF MACHINES

CAMPBELL: No. 425 Cutalator Abrasive Cut-Off, 4½" dia. capacity
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
WILLIAMS: 10' Pipe & Tube Cut-Off

THREAD MILLERS & TAPPERS

HALL PLANETARY: Model "D" Thread Miller
LEES-BRADNER: LT 6"x36" Thread
LEES-BRADNER: 40A Thread Miller
MURCHEY: #22 Horizontal threading and tapping machine, ¼" to 2½" dia. capacity, single spindle
NATCO: Vertical Tapper 16 spindle

MISCELLANEOUS

RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
CUT-OFF: Campbell, abrasive 425 Cutalator 4½" dia. Capacity
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Pipe & Tube, 10" Williams
PRESS: Screw. Gen. Flex. 3 ton
RIVETER: Gen. Engr. 24" throat
TEST STAND: Denison 918-AM Hyd.
LATHES: Blount Polishing Speed Lathe, 12" dia. x 48" centers
PUNCH SHAPER: Sentinel Shrewbury, Thiel type design (New)
SHAPERS: Hercules 22" (New)
SHAPERS: Dimco 16 to 33" (New)
GRINDER: WICKMAN Optical Profile Form Grinder (New)

INSPECTION INVITED — Telephone HAnover 2-4520

TRIPLEX MACHINE TOOL CORP.

75A West Street, New York 6, New York **Cable Address TRIMACTOOL**

MACHINE TOOL ENGINEERS SINCE 1919

LATE MODEL MACHINE TOOLS . .

AUTOMATICS
1⅝" RA-6 Acme Gridley Automatic, Late
0/10" RA-6 Acme Gridley Automatic, 1942
1¼" Cleveland, Model A, 1945
2" Cleveland, Model A, 1942

DRILLS
No. 83A Natco Single Spdl. Latest
10 Spindle Barnes, Hydraulic, 1942

DRILLS, RADIAL
4' Hammond, New
3' 11" Archdale, 1947

DRILLS SENSITIVE
No. 2B-S Edlund, 1947
No. 2 Wa S Assy 2 Spindle, 1942

GEAR EQUIPMENT
No. 6 Gleason Revacycle Generator, 1940
No. 6455A5 Fellows Gear Shaper, 1943
No. 72 Fellows Gear Shaper, 1942
No. 7LS Fellows Gear Lapper, 1942
Pratt & Whitney Gear Grinder, 1942
6" Red Ring Gear Shaver, 1941
15" Red Ring External Lapper, 1942
Red Ring Universal Gear Checker, 1942

GRINDERS, CYLINDRICAL
14"x108" Norton Plain Type C, 1942
14"x60" Landis Type C, Pl. Hyd, 1941
10"x19" Landis Type C, Pl. Hyd, 1942

GRINDERS, INTERNAL
No. 24-35 Bryant Hydraulic, 1943
No. 16 CP 16 Bryant Hydraulic, 1942
No. 10-16 Bryant Hydraulic, 1942
No. 172 Heald Hyd. Cap. 1940
No. 50 Heald Plain Hydraulic, 1941

GRINDERS, SURFACE
No. 22 Heald Rotary, 12" Chuck, 1943

GRINDERS, THREAD
No. 31 Excello Thread Grinder, 1941

GUN BARREL MACHINES
No. 1½x30 P & W Reamer, Latest
No. 1½x50 P & W Rifler, Latest
No. 1½x30 P & W Reamer, Latest

LATHES, ENGINE
20"x240" LeBlond Heavy Duty, 1941
22"x72" Schaerer (Swiss), 1947
16"x30" LeBlond, 1942

LATHES, PRODUCTION
No. 3FU Foster Fastomatic Plates, 1942
No. 3D Gisholt Simplimatic, 1939
No. 12 Sundstrand Stub Lathe, 1942
10"x12" LeBlond Multi-Cut, Late
Lipe Carbo-Matic, 1942
Lipe Mechanical Carbo, 1942

LATHES, TURRET
H-5 Libby Universal, 1940
No. 5 Gisholt Universal, 1942
No. 3 Gisholt Universal, 1942
No. 2 Warner & Swasey Simplified, 1941

MILLS, PRODUCTION
No. 2048 Cincinnati Vert. Hydrotel, 1938
08 Cincinnati Vertical, 1943
No. 3A Sundstrand Copy Mill, 1942
Hall Planetary Form Mill, 1942

MISCELLANEOUS
2000 HP midwest Dynamometer, 1942
75 HP Gardner-Denver Air Compressor, 1942

PRESSES
650 Ton Verson Double Action Toggle Press, 1940

SHAPERS
24" Stockbridge, M.D.

Partial listing — Write for latest stock list

INDIANAPOLIS *Machinery & Supply Co.*
1961 S. Meridian St. . . Indianapolis, Indiana

LATE MODEL TOOLS

BORING MILLS
36" Bullard Vertical Turret Lathe

LATHES
14"x8' STAR Engine Lathe
28"x8' AMERICAN Pacemaker Lathe, '42
20"x10' LODGE & SHIPLEY Selective Grd. Hd.
20"x144" centers LeBLOND Geared Head Lathe, 1942

AUTO. LATHES & TURRETS
#5DE POTTER & JOHNSTON Auto. Turret, 1941
#3M POTTER & JOHNSTON Auto. Turret, 1943
#1NS LIBBY Heavy Duty Turret Lathe

GRINDERS
#104 RIVETT Internal-External Grinder, '42
6"x18" LANDIS Type C Plain Grinder, '42
8"x16" CINCINNATI Plain Saddle Type Grinder
6"x18" NORTON Vert. Spindle Surface Grinder
18"x72" LANDIS Type C Hyd. Pl. Grinder, '42
10"x30" LANDIS Type B Pl. Cyl. with Gap Bed
#16/28 BRYANT Hyd. Internal Grinder, '42
#73 HEALD Internal Centerless Grinder, '43
#YG-185 JONES & LAMSON Internal Thread Grinder, new
#35 HEALD Cylinder Grinder

DRILLS
24" CINCINNATI BICKFORD Upright Drill, 1950
32" CINCINNATI BICKFORD Upright Drill
5'9" CINCI. BICKFORD Radial, Gear Box, M.D.
5' REED PRENTICE Radial Drill
ES NATCO Mult. Spindle Drill—Hyd. table, 1942
#35 ALLEN 3-spindle Hand Feed Sens. Drill
#425 BAKER S.S. Heavy Duty Drill
#2MS LELAND GIFFORD 4-spindle Drill

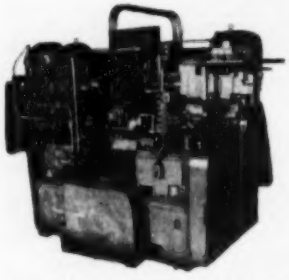
GEAR EQUIPMENT
#04 FELLOWS Gear Shaper
#12 FELLOWS Gear Shaver, '43
#725A FELLOWS High Speed Gear Shaper, '42
#36BM GOULD & EBER, Gear Rougher, 1941
36" NORTON Draw Cut Shapers (2), '48

MISCELLANEOUS
15" BETTS Vertical Slotter
#3L LAPOINTE Hyd. Broach, 1945
#½B P&W Two Spindle Reaming Machine, '44
4½"x36" P&W Model C Thread Miller, '43

WIGGLESWORTH INDUSTRIAL CORP.
203 BENT ST. CAMBRIDGE 41, MASS. KIRKLAND 7-5242

1—TRUNNION TYPE CHUCKING MACHINE

With the Following General Specifications:



For good late type metal working machinery, Call, Wire, or Write.

Six station trunnion with two jaw hydraulically operated chucks—capacity up to 5-5/15" diameter.

Right Hand Side of Machine has three stations for boring or turning and one station for threading with lead screw.

Left Hand Side of Machine has three stations for boring or turning and two stations for threading with lead screw.

Machine heads "V" belt drive from individual direct current variable speed motors. Hydraulic feed to all heads, interlocked with trunnion position.

Coolant pump and Hydraulic pump driven by 440 volt, 3 phase, 60 cycle motors.

Special cutter heads, Landis tap, Landis die head also available with machine.

Built in 1946. Immediate delivery.

COOK COUNTY MACHINERY COMPANY
1036 WEST LAKE STREET CHICAGO 7, ILLINOIS

- ‡12 Martin Hydraulic Marking Machine, M.D.
- 3" UNIVERSAL Horizontal Boring Mill
- ‡3 LODGE & SHIPLEY Duomatic Lathe
- BAIRD Cut & Carry Drawing Press
- ‡72 HEALD Sizematic
- 24"x6' c.c. LODGE & SHIPLEY Engine Lathe, Selective Head, M.D.
- 4" RICE BARTON SPLINE MILLER

Numerous Other Machine Tools

CURRIER MACHINE SALES
1055 State Street, P. O. Box 1503
New Haven, Conn.

SQUARING SHEAR

140" x ⅜" E. W. Bliss Motor Drive

WEST PENN MACHINERY COMPANY
1310 Horne Bldg. Pittsburgh, Pa.

TURRET LATHE

J. & L., 21¼" x 24", Serial ‡40,215. Priced right.

W. C. COWDEN MACHINERY CO.
Syracuse 4, N. Y.

NEW LATHES AT BARGAIN PRICES

New 18" x 80" Centers MEUSER LATHE and 24" x 120" Centers MEUSER LATHE. Complete with Taper Attachments, Chucks and all equipment. *GAP BED TYPE.* Available from stock all sizes up to 32" Swing. Will trade for other equipment.

WINSTON MACHINERY CO., INC.
326 W. OHIO ST. INDIANAPOLIS 2, IND.
PLaza 2408

SOME LATE MACHINES STILL AVAILABLE

BORING MILLS

Cleveland 2½" Bar Cap.
Giddings & Lewis No. 6, 3" cap.
Giddings & Lewis No. 32, 3½" cap.
King 42", 72" Vert. 2 rail heads
Niles-Bement-Pond 4½" Bar
Niles-Bement-Pond 60" Vert.

DRILLS AND RADIALS

Bausch Multi-spindle
American 6'x15" Univ.
Buffalo #2 Motor Spindle
Cincinnati Bickford 6'x13" col.
Walker-Turner Radial, 2½'
Natco #12 20 spindle drill
24" Sibley Sliding head
Foote-Burt #25 3" cap.

3 dimensional Engraving Machines similar to GK2 Deckel Ratio 1-1.5-1-10 NEW

ENGRAVERS

Gorton #1A, ME
Gorton #3B 3 Dimensional

GEAR EQUIPMENT

Barber-Colman #2
Barber-Colman #12 Hobber (3)
Fellows High Speed Shapers 712, 725, 71
Fiather 72" Cutter
Gleason 3" Straight Bevel Generator
Gleason #4 Angular Bevel Tester
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
National Broach Rad Ring Lapper, Shaver
Schacherl & Shutte #1 Hobber
Fellows #20M Redliner

GRINDERS, MISCELLANEOUS

Bryant #5 Internal, chucking
Cincinnati 6x18" Cyl. Hyd.
Heald #73 Internal centerless
Heald #81 Internal Gagomatic
Heald 72A3 Int. Centerless Sizomatic,
Landis 6"x30" Type C Cyl.
Majestic Internal
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 6"x30", 10"x18" Type C cyl.
Norton 14"x96" cyl.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer
Pratt & Whitney Radius #R6, K.O. Lee Tool
Sellers 6T Tool
Van Norman #646 Crankshaft
Wicaco Internal

GRINDERS, SURFACE

Abrasive 8x24", #33 Vert. & #34
#10 Blanchard 16" Chuck
Blanchard #16, 26" Mag. Chuck
Heald 22—12" chuck, Arter 12"
Norton 6x18" Hyd., Coolant
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base

LATHES

American 14"x30
Bridgeford 36"x20', 32"x16'
Lodge & Shipley #3 Duomatics
Hardinge Precision 9", 1" Collet Cap., Rivett
Hendey 12"x42" and 12x30", 1941
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed
Lipe-Carbo 12"x18" (2)
Putnam 42"x17'
Sebastian 12"x4' G.H.
Wickes 32"x35' Geared Head
Reid Small Piece #9WSL
Sundstrand 8x15"
Sundstrand 15" Stub
New 16, 18, 20", Immediate Del.

MILLS, PLAIN, UNIVERSAL PROD.

Archdale Plain, 14", Prod.
Brown & Sharpe #3B Plain, Late, 3A
Brown & Sharpe #21, 2L Univ.
Cinn. 08 Plain, #2 Univ. Dial Type
Cinn. No. 3, 4 Plain Spd.
Hardinge Model 884
Kent Owens 1V
Milwaukee #2B, Plain & Univ.
Simmons Micro-Mill #1A
Sundstrand #00, Rigidmils
Sundstrand #3A Rigidmil with Copying Attach

New Universal Mill with dividing heads and vertical attachments

MILLS, VERTICAL

Brown & Sharpe #3 single pulley drive
Cincinnati #3, #4 hi-power
Cincinnati 00 Vertical
Morey #12M Profiler, 2 sp.
Pratt & Whitney Profiler 12B, 2 sp.

New Vertical Mill universal table, swivel head

PRESSES

Bliss 645, 650 Hi-Production Presses
Bliss #630 Hi-Prod. Roll Feeds
Bliss 18, 21, OBI, 58, 62, 162, OB
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton, 55, Bliss 74½
Hamilton 850 Ton S.S.
Niagara Horning, 15 Ton
Niagara A1¾, O.B.I.
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing
Walsh No. 3 O.B.I. 23 Ton

TURRET LATHES

Acme 6W Fox 2-9/16" Cap.
Brown & Sharpe, #2 Hand, #10, 11
Doerer, 6 2" Shell Turret (2)
Foster #2B 2½" Cap.
Gisholt #2L Cross Sliding Turret
Morey #2G Late
Oster 601WD, #2 Simmons Microspeed
Warner & Swasey #1A, Timken Head
Warner & Swasey #1, 2, 3, 5 Late

MISCELLANEOUS

Automatic, Cleveland Model B 1-1/16"
Automatic B & S #00G, 0G, 2G
Automatic 4 Sp. 1½ Conomatic
Automatic: Bechler ¾" Like New
Band Saw: DoAll Zephyr 36"
Band Saw: #8 Marvel
Hacksaw: Peerless 6"x6"
Hacksaw: #6A Marvel 6x6 cap
Honer: Micrometic H-4
Keyseater: Davis, Baker, M & M
55 Split & Pipe & Threader
Oshr-Williams #915 Pipe & Nipple Threader
Shapers: 24" Rockford, 24", 28" Gould & Eberhardt, Many Others
Shears Power: George Ohl 10' 3/16", 10' x 16 gauge, 11' 16 gauge
Welder: 50 KVA Elster Air Operated
Welder: Taylor-Winfield 50 KVA Hi-Wave

HYDRAULIC EQUIPMENT

SELF CONTAINED PRESSES

500 Ton Shaft Straightener 24' Long Bed. Watson Stillman
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
50 Ton William & White Gap Press, 20" St. 54"x20" Bed—24" opening
600 Ton William & White Up-Moving Ram 42"x60" platen 12" str., 24" opening self-contained

MISCELLANEOUS PRESSES

300 Ton Watson Stillman 24x20" Platen 11" St. 21" opening

All Hydraulic Equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your Hydraulic problems.

NEW IN STOCK

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No. 72H Gould & Eberhardt universal. New in 1942 and used very little.

PRESS BRAKE

10'6"x1/4" Cincinnati type. New 1941.

BROACH

12 ton, 32" stroke No. VU 12 Lapointe vertical hydraulic pull up, new 1948.

BROACH GRINDER

No. RG36-51 Colonial round broach grinder, serial No. M 11299, new in 1948.

DRILL

Two No. 7½-A-14 Baker two way hydraulic horizontal with 7½ HP motors. New 1946.

DRILL & TAPPER

Natco two way horizontal hydraulic, indexing fixture, total horsepower 17, new 1947.

GRINDER

10"x18" Landis type C hydraulic, serial No. 25805, new 1942.

GRINDER, INTERNAL

Three No. 24-36 Bryant, new 1941
One No. 16-28 Bryant, new 1943.

GRINDER, DISC

30", No. 84A Gardner double end opposed disc with hoppe and disc feed, 25 HP spindle motors, new 1938.

GRINDER, SURFACE

12", No. 22 Heald rotary, serial No. 9874, new 1940.

GRINDER, THREAD

No. 33 Excello, new 1943. Now arranged for groove grinding.

HONING MACHINES

No. 172 Barnes, new 1942.

Two No. 2606 Barnes 2 spindle, index tables, new 1938 & 1939.

No. 2610 Barnes, new 1940.

MILLER, THREAD

8"x16" Hanson Whitney, new 1941.

No. CT36 Lees Bradner, new 1941.

MILLER, SPLINE

Two 4", Model M-80 Taylor & Fenn, new 1939 & 1942.

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500 ton Baldwin Southward, 42x52 bed, 20" stroke, 56" daylight. New 1939.

1000 ton Baldwin Southwark, 42x54 bed, 20" stroke, 56" daylight. New 1940.

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No. 5 FOSTER Ram Type Universal Turret Lathe, bar feed, taper attachment, motor in base

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36" BULLARD New Era Type Vertical Turret Lathe, spiral drive 3 jaw chuck table, rebuilt

24" BULLARD New Era Type Vertical Turret Lathe, side head, motor drive, threading attachment

100" BERTRAM (Niles Patterns) Vertical Boring Mill, 2 heads on rail, rapid traverse, new 1932

No. 1 DOUGLAS Plain Horizontal Mill, table 8"x32", power feeds, motor in base, No. 40 taper, new 1942

No. 2B KEARNEY & TRECKER Plain Horizontal Mill, AC—MD

No. 2B KEARNEY & TRECKER Vertical Mill, motor in base, rapid traverse

No. 4B KEARNEY & TRECKER Plain Horizontal Mill, motor in base, rapid traverse, vertical head

No. 5 CINCINNATI Plain Horizontal Mill, rectangular overarm, MD

No. 5-60 CINCINNATI Plain Hydromatic Mill, 1942

No. 3 AVEY Type MA6—4 spindle Drill, Aveymatic power feed, No. 3 Morse taper, new 1942

4' AMERICAN High Speed Sensitive Radial Drill, 8" column, AC motor on arm

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25A HEALD Rotary Surface Grinder, 24" diameter, magnetic chuck

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Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Rot. Surf. Grinder 12" chuck 1947.
Dual All Steel Press Brakes 9' & 10' 14-Ga. 1947.
Hilles & Jones 12' Pyramid Roll ¾" cap.
Baker No. 1 Vert. Keyseater 1½" cap.
Sheffield Model 101 Thread Grinder 1945.
Nazel #3-B Vert. Air Hammer A.C. M.D.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Headey 16"x8' bed G.C.G. Lathe 1938.
W & S No. 4 Ram Type Grd. Hd. Turret Lathe
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cont. Vert. Miller.
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Foster 2-F Fastomatic Hyd. Turret Lathe.
Kempsmith No. 2 Vertical Maximiller M.D.
Heald #70-A Rod Head Sp. Internal Grinder.
Springfield Planer Type Surf. Grinder.
Cochrane-Bly Tool Room Vert. Comb. Miller-Shaper.
P & J #2-M Auto. Prod. Miller, 2 Tables.
Foote-Burt #25 Nat. Col. 1-Sp. Hvy. Drill.
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FRANKLIN 4½" Bar; table type; M.D.
LANDIS #40, 4" Bar; floor type; M.D.
LANDIS #35 floor type; 3½" bar; M.D.
NILES 6" bar floor type, motor drive

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BULLARD 8", 16" 6-spdle. "A" Mult-au-matic
COLBURN 72", 2 heads PRT. M.D.
NILES 63"; motor drive (heavy)

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CINCINNATI 1-30 Duplex Vert. Hydr.

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CINCINNATI BICKFORD 6'15" Univ.; M.D.
WESTERN 6' arm, 22" col. motor drive; late

DRILLS—Miscellaneous
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BARNES H-3 Hydram; hydr.; inverted; late
BARNES H-3 Hydram; hydr.; M.D.
BARNES 20" 4-spindle Camel Back; Late
BARNES 24" all geared; Camel Back; M.D.
BODINE #42-20 multi-univ., dial feed; M.D.
MOLINE 6-spindle Hole-Hog 3⅝"; M.D.
NATCO No. 14 Mult.; Rect. Hd.; PRT; M.D.

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CROSS #1, #40, #45 Tooth Rounders; M.D.
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FELLOWS Nos. 61A, 6Z2, 71S, 7S, 7, 7A, 7S, 72, 77 High Speed Gear Shapers; late
FELLOWS 15-LS Lapper; late
GLEASON 5" & 12" Straight Bevel Gen.; late
GLEASON #4 & #6 Tester, Late Type
GLEASON 10", 11" & 18" Bevel Gear gen.
GLEASON 24", 37", 77", 96" Bevel Gear Planers; M.D.
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PRATT & WHITNEY 10" Gear Grinder; late
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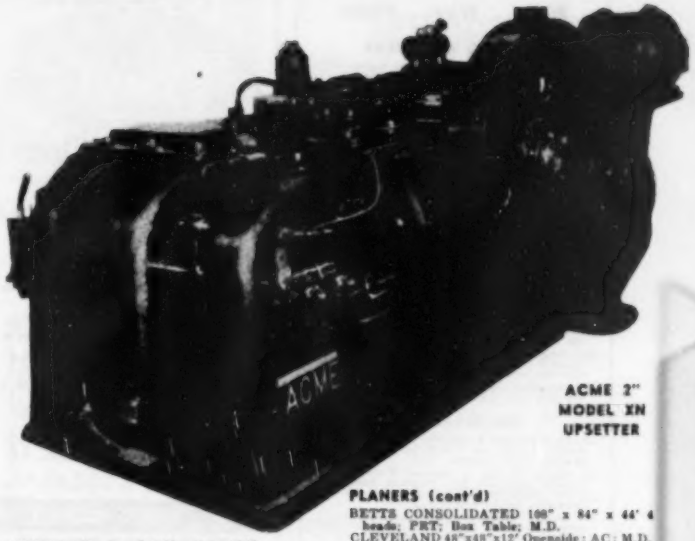
GOULD & EBERHARDT #36H. Late.
GOULD & EBERHARDT #36BM 3 spindle Auto. Rougher; M.D.
KOEFFER WM-11 Auto.; bench type; Late
PFAUTER RS1; max. dia. 30"; late

GRINDERS—Plain Cyl. & Univ.
CINCINNATI 6x18 cyl. Fl. Md.
CINCINNATI 14x72 Model EM Plain, Late
CINCINNATI Mod EA 6x18 Pl. Cyl. Hydr.; M.D.
HEALD 72-A-3, 72-A-5 Plain; motor drive
LANDIS 10x36, 16x36 C Pl. Cyl.
LANDIS 6x18" Type C Plain; Hydr.; late
LANDIS 30" x 240" Plain cyl., M.D.

GRINDERS—Surface
BILLITTER & KLUNZ 48x196" Way Grinder
HEALD #22 Rotary, 12" chuck; m.d. Late
PRATT & WHITNEY 14x36" Model B, Late
TAFT PIERCE 6" Rotary, M.D.

GRINDERS—Misc.
BRYANT No. 3, 5, 16-C-16, 16-CF-16, 24 Intl. Hydr.; Late
EXCELLO #48 Carbide Late
GLEASON No. 12 Tool Sharpener; late
HEALD No. 72-A-8 "Gagematic" Int.; Late
HEALD No. 72-A-3 "Gagematic" Int.; Late
HEALD No. 78 Internal Centerless; M.D.
LEMFCO 22x72" Mod. KG Crankshaft; Late
VAN NORMAN 666 Crankshaft Regrind
VAN NORMAN 639 Osz. type Radius; Late

LATHES—Engine & Mfg.
AMERICAN 36"x360" centers; 2 carringes
AMERICAN 36"x32" centers geared heavy
JONES & LAMSON "FAY" 20x25" Automatic; M.D., Late
LEHMANN 25x96" center; Timken; grd M.D.
LeBLOND 16x36" center; Auto.; Timken; late



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LeBLOND Mod. 7ACL Crankshaft; M.D.
LODGE & SHIPLEY 24"x96" centers; Late
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LoSWING 4x60", 8x24", 8x100"; late
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REED PRENTICE 16"x24" centers grd; M.D.
SPRINGFIELD 14"x48", geared; M.D.
SUNDSTRAND 10x60" Auto. Late Type

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MOREY No. 2 ram type TIMKEN
GISHOLT 1L Saddle type, M.D.
MAGDENBERG Model MWF-BG-250 Univ. table type; F.R.T.; 12" hole through spindle; cross sliding turret; M.D.; Late

MILLING MACHINES—Plain
BROWN & SHARPE No. 12 Plain; M.D.; late
CINCINNATI 0-8 Simplex; M.D.; late
CINCINNATI 4-48, 4 spindle, Tracer; Late

MILLING MACHINES—Universal
CINCINNATI No. 3; dial type; H.S.; late
VAN NORMAN #26; motor drive

MILLING MACHINES—Mfg.
GOULD & EBERHARDT 28 Cont. type; M.D.
INGERSOLL 32x24x16' Planer Type; 2 hds.
INGERSOLL 30x24x12' Adj. Rail Slab; M.D.
SUNDSTRAND Mod 3A Duplex 42" feed M.D.
TAYLOR & FENN M-60 Duplex Spline; Late

MILLING MACHINES—Vertical
CINCINNATI 0-8 Mod EA Auto. PRT; Late

MILLING MACHINES—Thread
HALL Style D Planetary, Late Type
LEES BRADNER HT 12", 54", M.D.; Late
LEES BRADNER HT 12x36" M.D.; Late
MOREY 12x30", 12x60" centers; late
PRATT & WHITNEY 4½x12 Mod. C; late

PLANERS
BETTS CONSOLIDATED 84" x 92" x 16' 4 heads PRT Box Table; DC Reversing M.D.

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BETTS CONSOLIDATED 108" x 84" x 44' 4 heads; PRT; Box Table; M.D.
CLEVELAND 48"x48"x12' Openside; AC; M.D.
GRAY 96"x36"x16', 4 heads PRT. Late.
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NILES-BEMENT-POND 72"x72"x30' 4 hds.; Rapid Traverse; M.D.
NILES-BEMENT-POND 60"x60"x12' Rapid Traverse, 3 swivel heads, box table, M.D.

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ESPEN LUCAS No. 670 30' cap Hydr.; Late
HELLER Model SS-1, 6¾ Cap Cold Saw

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PRATT & WHITNEY 6" Vertical; M.D.
PRATT & WHITNEY Mod. M 1251 10" Vertical
LYND FARQUHAR 26" Openside; M.D.
NEWTON 15" Slotter; M.D.
ROCKFORD 20" vertical, Hydr.; Late

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BIRDSBORO 325 ton Vert. Hydr; Late
BLISS No. 410A Toggle Drawing; tie rod; stool gearing
BLISS No. 2½A geared toggle; dble. acting
GLEASON 15" Quenching; hydr.; M.D.
NATIONAL #5 H.B. Maxi-press (Forging)
UNITED ENG. 800 ton hydr. forging
WATERBURY Farrel 125 Ton; St. Side

MISCELLANEOUS
ACME 2" Upsetter; Mod. XN; Motor Drive
AJAX 8½" forging, upsetting; M.D.
BAKER #5 Keyseater; motor drive
BARNES No. 17S, 714 Honing; hydr.; Late
CHAMBERSBURG 500 H.P. Billet Shear
CROSS #45 Tooth Gear Chamfering Machine
DeLAVAL No. 194 Coolant Clarifier; Late
FISCHER No. 1, Oil Groover; Late
GROB OS-20 Metal Band Saw—Filer; M.D.
LANDIS 2" Dble. Spdle. Threaders; M.D.
LeBLOND #2 Barrel Lapper; M.D.; Late
MANVILLE 2C Auto Screw Slotter; M.D.
MANVILLE No. 2 Slotters; Late
MANVILLE No. 3 Trimmer; Late
MANVILLE No. 2 DSOD Reader; M.D.
MANVILLE 1A DSSD Heater; M.D.
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MATTISON 12"x16"x36" Surface Grinder—12"x36" magnetic chuck—Fosteria water filter—generator set—late type.

BRIDGEPORT #51B 252" Knife Grinder—traveling head type—automatic wheel feed—MD—late.

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BORING MILLS, 4½" Bar Defiance, Tblo. Type
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DRILL, RADIAL, 4' Western, M.D. (2)
DRILL, 24" Cinci. Rock. Tapping, M.D.
DRILL, No. 121 Baker, M.D.
DRILL, 16 Spin. Natco, C13-R
DRILLS, 21" Rockford Locator M.D. New
FACE GRINDER, 24" Bridgeport, 12" wheel
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GEAR HOBBER, No. 12 Barber Colman
GEAR PLANER, 11" Rimrocker Sweet
GEAR SHAPERS, Nos. 5, 5I & 5IA Fellows
GEAR CUTTER, No. 13 B. & S. Spur & Bevel
GRINDER, 20"x120" Landis Cyl. Hyd. AC
GRINDER, 16Y4G Bryant Int., 1943
GRINDER, Micro Internal, large capty.
GRINDER, SURFACE 14"x36" P. & W.
GRINDER, No. 6T Sellers Tool 1942
HAMMER, 1000 lb. Chambersburg Pneumatic, 1947
KEYSEATERS, No. 5 Baker, capty. 4"x30" M.D.
No. 5 M. & M., capty. 3"x30" M.D.
LATHES, 42"x50" cen. Putnam Grd. Hd., M.D.
24"/40"x13' bed Fay & Scott Gap M.D.
36"x20' cen. Putnam 2 carr. T.A. M.D.
32"x25' cen. Pitts, Sommerfield, 2 carr., T.A. '42
30"x10' cen. LeBlond Cone T.A.
25"x12' bed Bridgeford Grd. Hd. (2)
25"x12' bed B. & S. T.A., Grd. Hd.
16"x10' bed L. & S. T.A. Cone Motorized
16"x6' & 12"x6' Hendeys Grd. Hd. T.A. (2)
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20" Libby "C" 4½" capty.
No. 2B Foster Univ., 3½" capty., Bar Timken
No. 1B Foster Univ., 2" capty. M.D.
No. 00 Oster 1½" New
MILLER, No. 5-48 Cinci. Hydromatic Pl. M.D.
THREAD MILLER, 12"x60" Morey Shields '42
MILLER, No. 4 Cinci. Univ. High Power AC M.D.
MILLER, No. 4B B. & S. Plain M.D.
MILLER, No. 3B K. & T. Dbls. Overarm M.D.
MILLER, No. 0 Sundstrand Rigidmill, Hand
MILLER, No. 1½B K. & T. Univ., Grd. Hd.
MILLER VERTICAL, No. 1 Kempsmith Maxi Miller, M.D.
PIPE THREADER, 4" Oster, No. 304B, 1947
PIPE THREADER, 8" Oster & 2" Landis (2)
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PLANER, 24"x24"x6' Gray, M.D.
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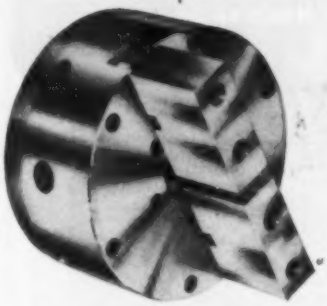

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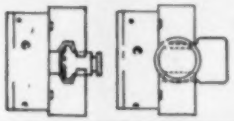

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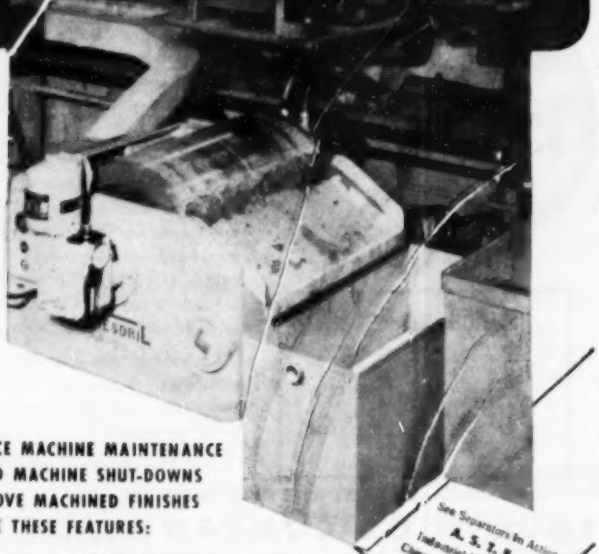

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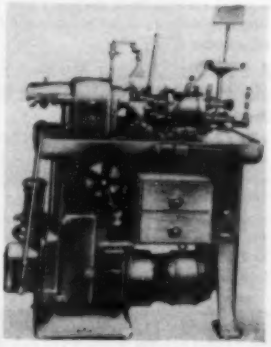

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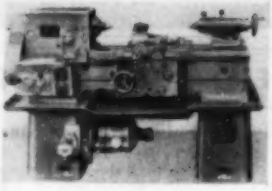

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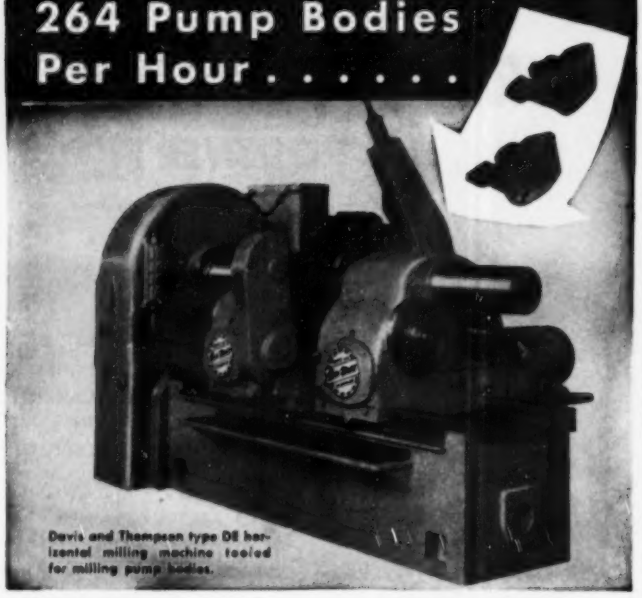

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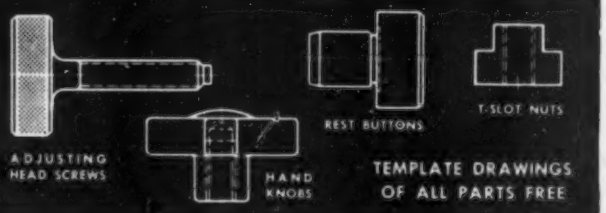

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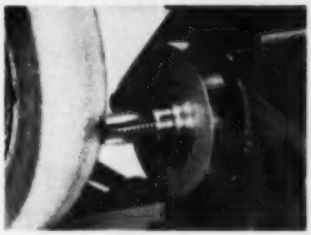

TAP IN POSITION FOR PRECISION SHARPENING

Photograph shows four-fluted tap in correct position for precision chamfer grinding on Blake Tap Chamfer Grinder.

WHAT PRECISION SHARPENING IS

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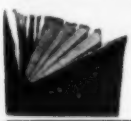

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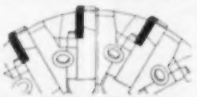

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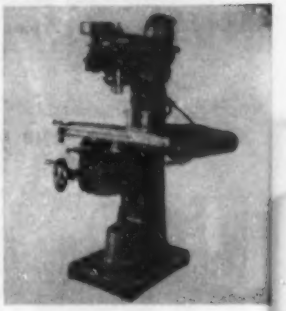

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SLAVERY was not abolished by Lincoln. He did end physical slavery, but man himself must end mental slavery to habit. Education will help, but the real problem is to breed a race of open-minded, inquiring men who welcome the chance to wonder, to question and to analyze—then to take a chance on a new idea that looks sound.

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COMPARATOR DIAL SNAP GAGE

Enables inspector to use both hands for checking. Note that the weight of part rests on solid anvil.

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Correct readings are obtained at once as the gages are applied on the work. There is no need of rocking back and forth, so often required in ordinary dial snap gages. This speeds the operation of turning or grinding when it is important to know how much is left on the diameter; .0001 indicator quickly reflects the size to the operator on the gage, giving control, confidence, and speed to the operator.

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Setting can be made direct to master ring gage, a gage block combination, or micrometer.

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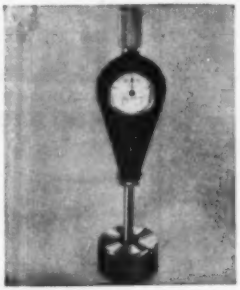

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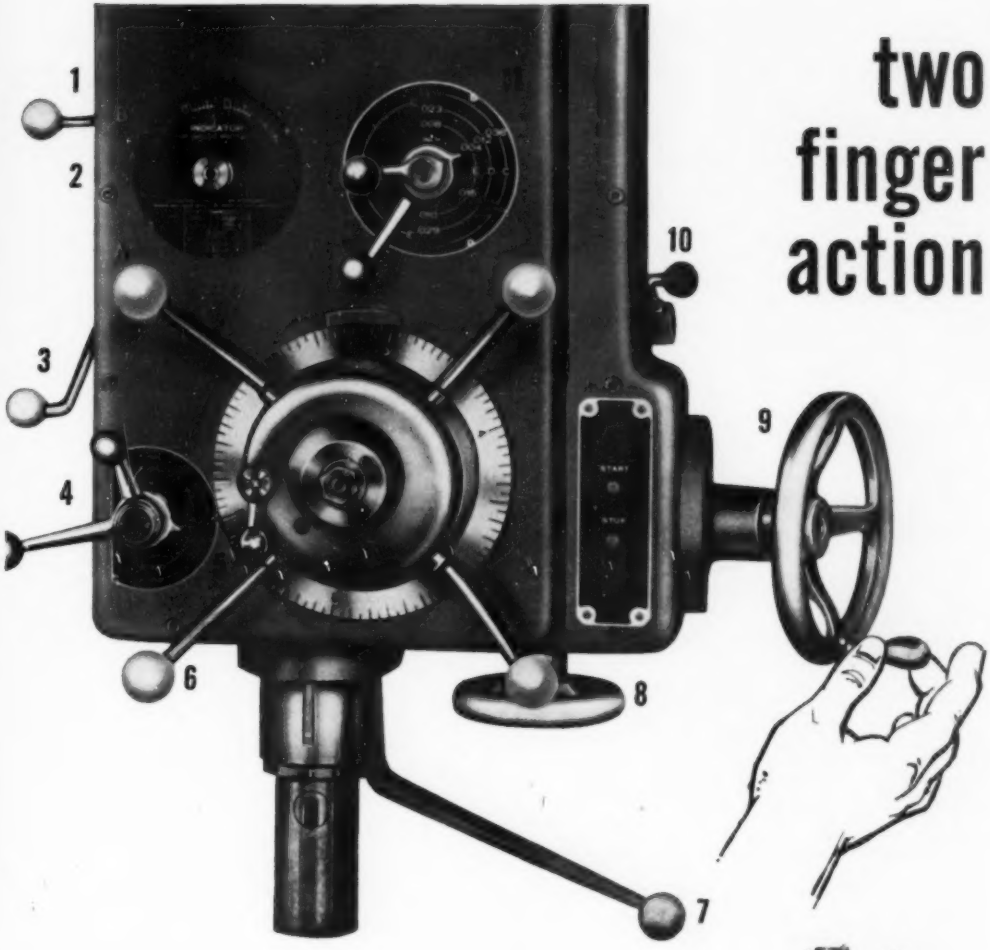
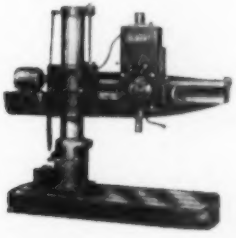
two finger action



Any Gilbert radial operator will tell you that the smooth, easy response of controls saves time, cuts down fatigue, and helps boost output. Furthermore, the operator has good visibility of the work **without** raising the head above a comfortable working height, because the spindle axis is close to the front face of the head.



Note clean, compact grouping of controls: (1) speed back gear, (2) speed and feed indicator, (3) head clamp lever, (4) speed change levers control 12 speeds; direct reading plate simplifies selection. (5) adjustable depth stop clamp, (6) spindle power feed is engaged by pulling any turnstile lever, (7) spindle reverse lever, (8) fine feed hand wheel, (9) head traverse hand wheel, (10) power feed engaging lever, (11) feed change levers provide six feeds (twelve with tap heads) shown on direct reading plate.

Ask your Gilbert representative for a demonstration, or write for Bulletin 349

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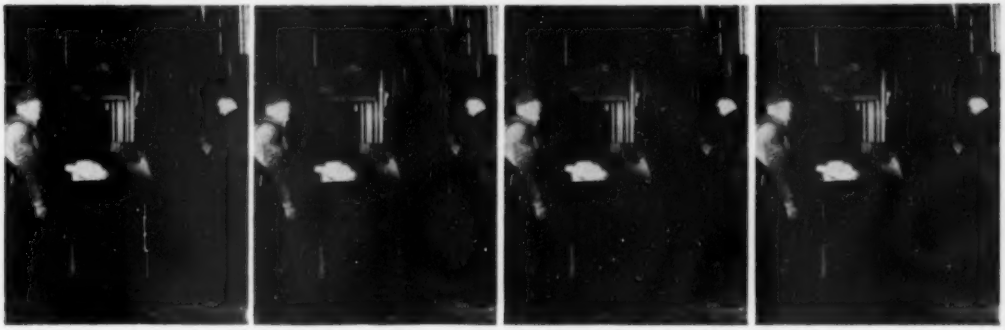
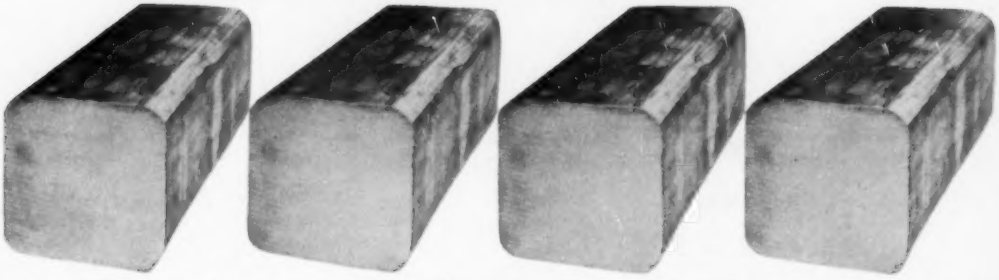


start with uniform TIMKEN® forging steels!



YOU can get uniform, high quality forgings and cut production costs too if you start by using uniform, high quality Timken® forging steels. With Timken forging steels, you're assured of uniform forgeability, uniform response to heat treatment, uniform machinability—from bar to bar and heat to heat. As a result, you have fewer rejects, fewer delays, fewer changes in shop practice.

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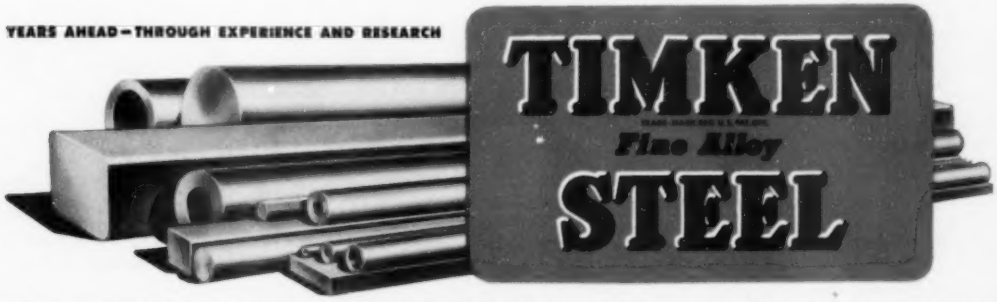
YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



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